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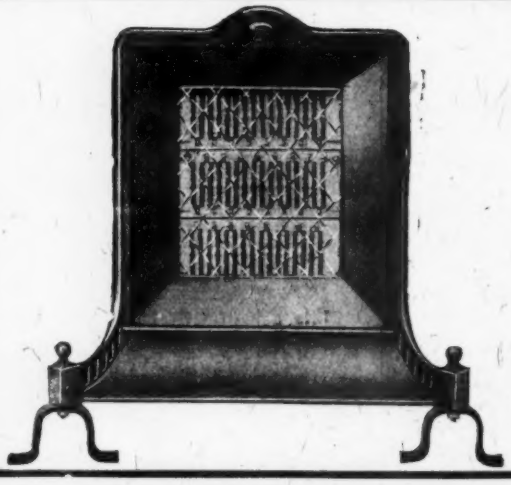

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ELECTRICAL REVIEW.

Vol. XC. JUNE 16, 1922. No. 2,325.

ELECTRICAL REVIEW.

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CONVENTION WEEK.

NEXT week the annual convention of the Incorporated Municipal Electrical Association will be held at Wolverhampton, under the presidency of Mr. S. T. Allen, and if the weather controller is well disposed, there is every reason to anticipate that it will prove eminently successful. Last year the prospects of the convention were ruined by the coal miners' strike, but this year a serious dispute has been brought to an end, and we are looking forward to a resumption of activity in the engineering industries, which will restore the missing load to the electricity supply industry, accelerate the reduction of prices charged for electrical energy, and facilitate the "Extension of the Uses of Electricity for Domestic Purposes," which is the title of a paper to be read by Lieut.-Col. W. A. Vignoles, D.S.O.

All the papers this year are by well-known engineers on technical subjects; nowadays the councillor members prefer to listen, and though occasionally excellent papers have been forthcoming from their ranks, with all due respect we think they are well advised.

We do not know the subject of Mr. S. T. Allen's address, but we know the author, and we are certain that whatever his text, his remarks will be worthy of the occasion. Lieut.-Col. Vignoles's subject affords unlimited scope, and is of the first importance to-day; if the Electricity Supply Bill is passed with the clause reforming the method of charging for electricity, it will greatly stimulate the development of the domestic load. Mr. E. Calvert will deal with administration, and Mr. R. A. Chattock with sub-station equipment, both of which subjects are calculated to evoke profitable discussions. The social side of the Convention has been equally well provided for; in such a district engineering and other works abound, and visits have been arranged at Stoke-on-Trent, Birmingham, and of course Wolverhampton, which will be well worth while.

Two items which usually appear on the programme this year are absent—the private meetings of the committee members and the engineer members respectively. We trust that this is a reliable symptom of the good understanding that obtains between the parties, and that the harmony of their relations will be maintained. The engineers and managers before the war, like their subordinates, were as a rule grossly underpaid, and any attempt to restore pre-war conditions would be both unwise and unjust.

We hope that, at some stage in the proceedings, an opportunity will be found to discuss the holding of a National Electrical Convention, which was advocated by Major Richardson last year, and is supported by the Council of the Institution of Electrical Engineers. There is no need to wait until the Exhibition of 1924; and there is no time to spare, if the scheme is to be inaugurated next year, when, we hope, industrial conditions will be on a sounder basis and a new era of prosperity for everyone in these islands will have opened.

On Thursday and Friday next the Tramways and Light Railways Association will hold its annual congress, at Bournemouth, under the presidency of Sir Arthur Stanley, G.B.E., M.V.O. Until Wednesday, the Institution of Mechanical Engineers will still be on tour in France and Belgium; and from Wednesday to Saturday the Institution of Municipal and County Engineers will be in conference at Cardiff. Evidently the latter end of June is the popular convention week, and the fact may carry some weight in fixing the date for the National Electrical Convention.

The Engineering Lock-out Ended.

THE lock-out in the engineering trades is at an end. The result of the ballot of the A.E.U. membership was announced on Tuesday; 75,478 votes being given for acceptance of the employers' terms and 39,423 against, the majority for acceptance was 36,055. The total vote was rather less than one third of the total membership of the Union. It was stated that arrangements had been made for A.E.U. members to return to work as quickly as they could be set on. The Union has suffered a loss of one and a quarter millions on the year's working on the general fund for 1921, and a deficiency of over £200,000 on its contingency fund, while the loss in wages has been put down at £4,875,000 in the case of A.E.U. members, and at nearly nine millions including the members of other unions. If the leaders' advice had been accepted some months ago this need not have been. Such is the costliness of the Extremist to Labour and such the cost of an unrepresentative ballot. We trust, however, that instead of returning to work with the iron in their souls, as one Union representative recently predicted, the employés will follow the advice of Mr. Brownlie, their president, and settle down to productive effort with the determination that the engineering trade, by which they and their employers live, and which is so essential to the well-being of the British nation, shall recover the ground that has been lost. Doubtless the news of the end of the dispute and the resumption of operations was speedily flashed round the world, announcing to our customers overseas that British engineering works are now hard at work delivering the goods, and that they have no longer any need to withhold their orders because of uncertainty regarding the situation. Wages and some other questions have still to be the subject of negotiations, and we may trust that these will be settled without much friction. There is a growing demand for an industrial truce, and the crying need for it is felt by the engineering industry.

Among the many lessons that should be learned from this deplorable dispute there is one that seems to us to stand out beyond all others. *The Times Trade Supplement* ends its leading article thus:—"If the engineering industry is to be restored to prosperity, some means must be found of avoiding these recurrent sectional disputes, which affect not only the men directly concerned, but thousands of others in subsidiary trades." Quoting the words with which the *Westminster Gazette* closed its editorial on "The End of a Sorry Dispute," we may say that "The real lesson of the dispute is the need for the creation of better organisation on both sides, with a network of joint conciliation committees, to which workshop difficulties can be referred, whose decisions will be respected by both sides. That until it is created there will never for long be peace in the engineering industry is a very safe prediction."

If these Press opinions be sound, as we believe they are, cannot we make some definite move in the direction of setting up such conciliatory machinery? If the men return to work with the un-British humiliation of being beaten, it must be remembered that the extremist views have been as powerful a weapon for their defeat as have the employers. Extremists are dangerous and costly in any industrial dispute on whichever side they use their influence. Moderation, harmony, good sense, and goodwill, which make for stability and all-round prosperity, they appear not to include among the more excellent qualities. If majorities are to rule, they must prevent the extremists from working mischief. Joint committees should be so organised that questions in dispute can be settled at an early stage by representative men from both sides. Strong and wise leadership of a truly representative character should be able to counteract the influence of those who are not averse to sacrificing their co-workers' interests if by so doing they can increase their own importance. Less selfishness all round is what we need. We have to recognise that all have rights and all have responsibilities; all classes are interdependent—all can succeed if each contributes its fair share.

The Compulsory Laying of Mains.

A QUESTION which nowadays exercises the minds of some undertakers who are rather hard up for capital is how far they are obliged to lay new mains on demand. These obligations were laid down in the Electric Lighting Clauses Act, 1899, which provides that six or more owners or occupiers of premises may require the undertaking to lay mains to supply them. A certain amount of obligation is laid upon the undertaker to comply with this, but the latter can insist on these persons giving a guarantee to take supply for three years at least, and on payment of an amount per annum not exceeding 20 per cent. on the cost of providing the mains. Moreover, if the undertakers consider that the request of the prospective consumers is unreasonable or that the provisions of the Act ought to be varied in their particular circumstances, they can appeal to the Electricity Commissioners, who exercise the powers formerly entrusted to the Board of Trade, and it is in their hands to say that the request need not be complied with, or they can authorise the undertakers to insist on a contract for a period greater than three years and on an amount greater than the 20 per cent. referred to above. Altogether, therefore, if an undertaking is short of capital and it would really be a hardship for it to comply with a requisition to lay further mains, it has really no grounds for being alarmed since such a number of safeguards are provided.

Gas v. Electricity.

DURING recent years, with one or two notable exceptions, gas engineers have shown a marked disposition to maintain harmonious relations with their electrical *confrères*, who are only too pleased to meet them half way; undoubtedly there is room for both parties, and while, in some respects, they are directly in competition with one another, there is no need for competition to become unfair or acrimonious. So long as both sides "play the game" they can jointly serve the public to the common benefit.

We regret, therefore, that Mr. Octavius Thomas, the newly elected president of the Wales and Monmouthshire District Institution of Gas Engineers and Managers, at a general meeting at Cardiff on June 8th, thought fit to make a savage onslaught on the electrical industry. He had a grievance against the Government in connection with the shipyards at Chepstow, where electrical plant had been installed in preference to gas, and after lauding gas for lighting, cooking, heating, and power in the most extravagant terms, he said (as reported in the *Western Mail*) that "electric lighting was destructive to the eyesight, nerves, and hair, and if persisted in, would convert us into a nation of Chinese, besides exhausting our coal supplies within a very short period. It was also, on the average, three times more costly than gas, light for light and conditions being equal. As for heating, it was only convected heat, therefore unstable, and the price paid for electric heat gave the consumer an electric shock at the first glance at the bill, notwithstanding that it was sold at a price below the cost of production. For power, certain claims were made on its behalf as to its convenience, which were magnified fourfold. Although sold at about one-third of the cost of production, it was more than double the cost of town's gas, even when gas was charged at a price approaching the lighting rate."

Apparently Mr. Thomas himself has "lost his hair," although we cannot suppose that he uses the electric light, which has got so badly on his nerves. The discoveries which he has made about the relative merits of gas and electricity will not carry conviction to the minds even of gas engineers; but it is a pity that he should tear a passion to tatters in this way whilst the occupant of a position of dignity and responsibility.

BALANCING THE RYMER-JONES MARINE GALVANOMETER COIL.

By J. RYMER-JONES.

IN the ELECTRICAL REVIEW of December 6th, 1918, particulars, with illustrations, have already been given of the Rymer-Jones marine galvanometer slide, including the improved and patented methods of suspending and balancing the coil, which is doubly wound, so that the twin windings can be connected up either for use in *series*, or else as a *differential* galvanometer. In that description reference is also made to several other improvements, viz.:—Employing *rubbing* and self-cleaning contacts in the place of pressing contacts; adjustments to place the soft-iron core in the exact centre of the aluminium frame on which the coil is wound; means of connecting-up to avoid static attraction when using the coil windings in series, or, alternatively, for differential purposes, as well as levelling adjustments required when the coil is suspended much more sensitively for use on shore.

The object of the writer of this article is to deal more explicitly with the details of the step-by-step process of suspending the coil, as shown in the diagram, and also to reduce the principle on which perfecting a balance is based to such a simple rule* that what has hitherto been a difficult problem, reluctantly undertaken even by an expert, becomes so simplified that it can be effected with comparative ease.

Suspending is effected *without employing solder* in order to preserve the natural tensile strength of the phosphor-bronze wire; and the coil is symmetrically suspended by reeving the wire through, say, three holes drilled in the coil pivots, and then simply keying the extreme end with an exceedingly small and pointed peg—whose tip has been dipped in liquid shellac varnish before pressing it in to secure the end tightly. The diameter of the hole near the pivot end is not much larger than the wire itself is broad, consequently whenever a wire breaks, the new piece used for re-suspending occupies practically the same position, so that the former balance of the coil is not very greatly disturbed, and can therefore be easily perfected.

The edges of the drilled holes are bevelled and smoothed, so that the wire may safely be drawn taut; and as it lies perfectly flat on the pivot ends the danger of frequent breaks—associated with soldered ends—does not exist. Moreover, as a phosphor bronze wire retains its elasticity and flexibility at this point, it is less likely than a soldered end to take a set when the coil is violently deflected, and so disturb the instrument's zero.

The balancing advantages of the special longitudinal and lateral adjustments of the coil's soft-iron core, and also the increased length of adjustment at the foot of the slide, will be fully appreciated by cable-ship electricians, the former as a convenient means for keeping the core in the centre of the coil's aluminium frame, and the latter for taking up, or increasing, the slack of the wire suspension.

The balancing process is very quickly effected by the two screw-threaded wires, placed at right angles to each other, and shown also in the illustration as passing through the central line of the pivot above the top end of the coil. The secret of success in easily effecting by their means a perfect balance depends on the fact that

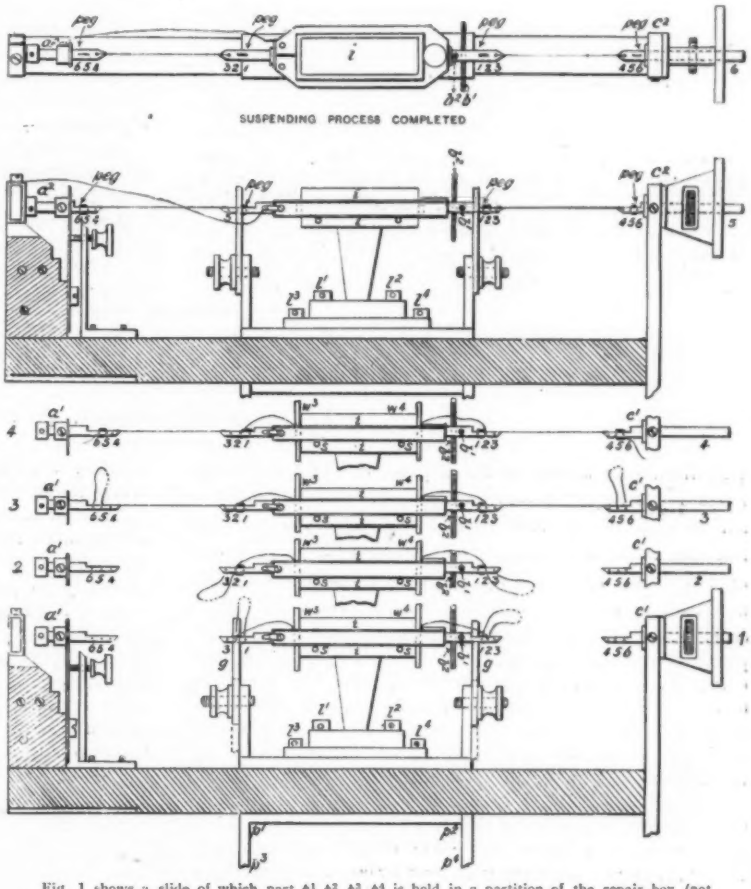

Fig. 1 shows a slide of which part b^1 b^2 b^3 b^4 is held in a partition of the repair box (not shown), ready to have its coil suspended. The guards *g g* can be turned out of the way during the operation. Suspending is commenced with pivots a^1 c^1 adjusted as shown, and with the iron core held by screws l^1 l^2 l^3 l^4 in its midway position.

The coil frame is placed on the two hard metal pins *s s* temporarily inserted, while suspending, into holes drilled through the soft iron core; a wooden wedge at each end keeps the coil at the desired distance from the iron core, and a second and *separate* wooden wedge is inserted at each end, to hold one end of a piece of phosphor-bronze wire between the iron core and the coil frame. The end being thus securely held, the operator has both hands at liberty for the rest of the suspending process. When the wire has been reeved through the holes in both spindles, it has to be permanently secured at both ends by wooden pegs inserted in holes 1 and 6, pressed in tightly, and then any unnecessarily long ends are cut off with the wire nippers provided, with other convenient tools, in the repair box.

RYMER-JONES MARINE GALVANOMETER SLIDE.
Coil doubly wound for either series or differential connections.

both these balancing wires pass exactly through the *centre line of suspension*, so that the alteration of the one (b^2), whose function is to equalise the balance between, say, the *back* and *front* of the coil, does not affect the degree of balance already existing between the two *sides;* and, conversely, the same is equally true with regard to an alteration made in the wire (b^1), intended to equilibrate any difference between the two sides of the coil, not affecting any difference in the degree of balance already existing between the back and front. The resulting important advantage of these two wires (b^2 and b^1) being quite independent of each other in their influence on the coil's balance, is that any inequality between the back and front, and also between

* For the convenience of perfecting the balance frequently, the galvanometer can always stand in the cradle on the testing table, with the keys, &c., &c., around it.

the two sides, may be separately tested for, and a correction for the one made immediately after the other with only one withdrawal of the slide from the galvanometer.† This very greatly simplifies balancing and saves much time.

Principle on which a Good Balance is Speedily Effected.

If, starting from a perfect balance, the wire b^2, intended to equilibrate the *back* and *front*, causes a displacement of the spot of, say, ten divisions from zero when turned through *one complete cycle**, this becomes a constant (c^2) *for the particular slide coil used*, and an accurate guide as to how much the same balancing wire should be turned to correct for an error (e^2) at some other time. *E.g.*:—If the displacement error (e^2) be five divisions from the instrument's zero, obviously half a turn in the appropriate direction will correct a balance in this respect.

A second constant (c^1) may in the same way be obtained for the other wire intended to bring about a balance for e^1 between the two sides. It will, of course, be necessary to turn the cradle always through the same angle, say 20 degrees, when observing the want of balance in scale divisions. (See Pat. Spec. No. 117,038, January 7th, 1918, for details of the balancing cradle; and Electrical Review, May 2nd, 1919, p. 492.)

The process becomes even more simplified if reference is always made as to which is, say, the heavier. Thus, "back five, right ten," is easily remembered, and means that the *back* is *heavier* by a difference represented by five scale divisions; and also that the *right side* is *heavier* than the left by a weight represented by a deflection of ten divisions from the instrument's zero.

These two constants (c^1 and c^2), recorded in the galvanometer-case, will show through what fraction of a turn, or how many turns, the particular balancing wire should in each case be turned round to re-establish a perfect balance in both respects.

Rule for Balancing.

Front too heavy by e^2 divisions, turn front (flattened) end of b^2 in direction of hands of watch e^2/c^2 turns.

Back too heavy by e^2 divisions, turn front (flattened) end of b^2 in opposite direction to hands of watch e^2/c^2 turns.

Right end too heavy by e^1 divisions, turn right (flattened) end of b^1 in direction of hands of watch e^1/c^1 turns.

Left end too heavy by e^1 divisions, turn right (flattened) end of b^1 in opposite direction to hands of watch e^1/c^1 turns.

† To turn the adjusting wire round, hold the flattened end in the cut in the head of the screw device provided in the repair box.

WIRELESS BROADCASTING.

By E. W. MARCHANT, D.Sc.

The discussion which has taken place recently in the lay Press regarding "Broadcasting" has not unnaturally led to some consideration of its possible future. In America there are hundreds of thousands of persons who have wireless receiving apparatus with which they are able to hear messages that are sent out from the broadcasting stations that have been established in different parts of the country, and one hears of radio parties being given at which a radio concert sent out from the broadcasting station is the attraction. It seems not unlikely that a similar enthusiasm will spread through this country as the possibilities of broadcasting by wireless become more fully known.

The fascination of wireless is remarkable, and I do not think there are many amateurs who have ever taken up wireless as a hobby who have entirely given it up. The "mystery" of sitting in one's room and hearing a message that has been sent from a place which may be hundreds of miles away is one that wears off to some extent, but never seems to disappear entirely. Although the "boom" in wireless may not remain at its present strength in the newspapers, it seems not unlikely that, as greater knowledge of the possibilities of wireless and greater skill in the manipulation of the apparatus are gained, the use of wireless will tend to grow rapidly. Whether wireless becomes popular with the non-technical user depends, to a very large extent, on the way in which broadcasting is controlled. When the novelty of wireless itself has worn off, the use of the broadcasting system will depend to a very large extent on the character of the programme of the information or concert that is transmitted. As in the case of a gramophone, the greater use and extended appreciation of its possibilities should lead to an improvement in the character of the "records." At the same time, it should be emphasised that, under favourable conditions, there is a much more faithful reproduction of music or of the human voice on the wireless telephone than can be obtained from a mechanical record.

It is well, however, to lay stress on the limitations of the system. The greatest trouble in wireless reception is caused by "atmospherics," and, no doubt, in the summer time there will be a good deal of interference from them. Fortunately "strays" are much less serious on the shorter wave lengths than they are on the longer ones, and although there may be some difficulties, it does not seem likely that they will be so great as seriously to prejudice the use of the broadcasting system. Further, it is obviously inadvisable to have broadcasting stations (working on the small range of wave lengths allowed) too near together, otherwise the interference between stations is likely to become serious; as it is, those people who live nearly midway between two broadcasting stations are likely to be jammed if the two stations are working simultaneously, unless there is a considerable difference in their wave lengths.

There is another obvious limitation to broadcasting: that is, that it is controlled entirely by the transmitting station. There is no possibility of criticism by the audience. It has been suggested that the use of broadcasting in wireless will have a prejudicial influence on the newspapers. It was pointed out the other day that a newspaper reader could pick out the information that he wanted, whereas the person who "listens in" from a broadcasting station has to wait until the particular item of news that he wishes to hear comes through. The effect of these stations on the newspapers, therefore, is not likely to be very great. With the power that it is suggested should be used by broadcasting stations (about 1½ kilowatts), it should be easy to pick up messages with comparatively simple receivers 40 or 50 miles away from the station. Many amateurs, no doubt, will claim that this distance is less than that over which they are able to send messages with much smaller powers. Claims have been made by amateurs in Manchester that they are able to communicate with other amateurs near London with a transmitting power of only one watt, and that they are able to maintain continuous communication. With such powers, however, it must be obvious to any person who is acquainted with the operation of wireless apparatus, that very critical and sensitive adjustments must be made in the receiver, and for ordinary practical work the power that is required will be very much greater. Although it will, no doubt, be possible to pick up the 1½-kilowatt stations at much

greater distances than 40 or 50 miles, I think it may be assumed that this will be about the practical range for most receiving sets. At sea, of course, very much greater distances than this have been covered. There are records, even in pre-war days, of signals from a 1½-kW ship set being heard many hundred miles away. In 1915 Mr. Vyvyan, at the Institution of Electrical Engineers, stated that in a certain area outside Melbourne communication at night was very frequent with the Cocos Islands, 2,500 miles away, where a 1½-kilowatt set was installed (these signals were received on a crystal or other "non-valve" detector); but this, of course, is very far from being a normal range of reception for these detectors. There have not been many records published recently of what has been possible with small powers using valves, but the sending of messages across the Atlantic by amateurs in America, last February, which were received in this country on four or five evenings during the fortnight that the trials lasted, is evidence that the 1½-kilowatt set, under suitable conditions, may be able to transmit several hundred miles. Freak transmission, however, is a very different thing from the regular transmission which must be looked for in a broadcasting station, and a receiver in the hands of an unskilled person is very much less sensitive than one in the hands of a skilled operator or amateur wireless enthusiast. A range of about 100 miles for a 1½-kilowatt set for most receivers will not be very far from the truth. In a notice published last week by one of the manufacturing companies it was stated that its cheapest receiver would pick up messages at a range of about 25 or 30 miles. With a valve set using, presumably, two or three valves, the range would be extended to 50 or 70 miles, while with the largest set, which would presumably contain four or five valves, the range would be about 150 miles. These are conservative figures, but will represent, approximately, what an amateur ought to be able to do in "listening in" to broadcasting stations. No doubt as the operator becomes more efficient and skilful in the use of his apparatus he will get longer and longer ranges. He will try to hear signals from other broadcasting stations than those which are close to him, and as time goes on we shall, no doubt, have a very interesting record of freaks, such as those mentioned above.

It has been asked to what extent the broadcasting firms are likely to benefit from the business of broadcasting. The only advantage which they are likely to gain is the fact that a great demand is likely to spring up for wireless receiving sets. It is difficult to see how any form of levy can be made on receiving stations for the reception of the news which is sent out. It is impossible for the broadcasting firms to know who is receiving the messages they transmit, and the only advantage they have is the advertisement gained. The obvious way of maintaining the transmitting stations is either to use the money paid for the receiving licences to subsidise the firms which make themselves responsible for the stations, or else for the State to undertake the broadcasting itself. Of these two solutions the one that is likely to find most favour is the first. Those who are responsible for the public control of the broadcasting system are looking to the possibility of a very widely extended use of wireless receivers, and for that reason are laying down very stringent conditions as to the methods of reception that are being employed. There seems every likelihood that these anticipations may be fulfilled.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

SUMMER CONVENTION IN SCOTLAND.

(*Concluded from page* 797.)

On Wednesday afternoon the members were the guests of Messrs. Babcock & Wilcox, Ltd., Renfrew. They joined the turbine steamer *Queen Alexandra* at Broomielaw, and proceeded to Renfrew, where by special train they were conveyed to the works of Messrs. Babcock & Wilcox, and in parties were conducted through the various departments, finding much that interested them in the modern plant and manufactures. Rejoining the steamer, the company enjoyed tea and an evening sail down the Firth of Clyde. The weather was ideal for such an occasion, and the visitors had the opportunity of seeing the beauties of the Clyde estuary—including the Kyles of Bute—in their most attractive aspect. Dinner was served during the return journey, and before Gourock was reached the thanks of the company to their hosts for the delightful experience were expressed by Mr. J. S. Highfield, the president, and acknowledged by Sir James Kemnal, managing

Fig. 7.—The I.E.E. at Kinlochleven.

director of Messrs. Babcock & Wilcox. Apart from these brief remarks there were no speeches, the entire proceedings being of the most informal character. The party returned to Glasgow by special train from Gourock.

On Thursday, June 1st, the West Highland excursion

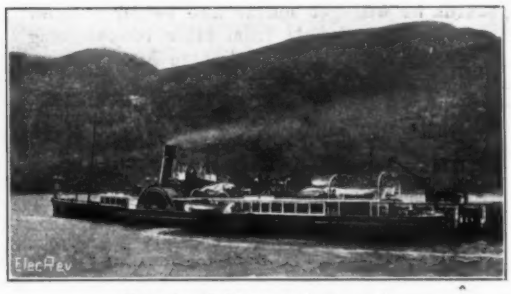

FIG. 8.—R.M.S. "FUSILIER."

commenced, members and their friends leaving Glasgow by special train; this proved to be a unique experience to many. The West Highland line of the North British Railway passes through some of the most magnificent scenery in Scotland, and undoubtedly the line has been splendidly engineered—Scotland in her most rebellious mood has been conquered. The scenery may be divided roughly into three sections—from Helensburgh to Ardlui, on "the bonnie banks o' Loch Lomond," the railway line hugs in succession the shores of three fine lochs—Gare Loch, Loch Long, and Loch Lomond—all of which lie in the shadow of the great hills; Loch Long is used by the Admiralty for torpedo testing purposes, and the torpedo station on the far shore and the line of platforms in the centre of the loch were noted with interest. From Ardlui to Garton the railway threads its course along a maze of stupendous crags; from Gorton to Rannoch it traverses the great moor of that name, the loneliest stretch of country in the kingdom, yet beautiful, where the difficulty of securing a solid foundation for the track was overcome by laying down brushwood.

Beyond Rannoch the Black Water on the left is the feeder for the reservoir of the Kinlochleven aluminium works, and the region to the left forms the principal catchment area for the hydro-electric schemes. At Corrour, the next station, the railway line attains its highest point, 1,350 ft., and Loch Ossian, further on to the right, is the highest of Scotland's lochs, 1,269 ft. above sea level. A little further north Loch Treig came into view, the marvellous reflection in which was a sight not to be forgotten.

A break in the journey was made at Tulloch, where, after a picnic luncheon, the party was able to inspect the source of supply of the new Lochaber water-power scheme of the British Aluminium Co., Ltd., which was sanctioned by Act of Parliament in 1921 (see p. 796).

Ben Lui, 3,708 ft.
Mr. and Mrs. Highfield.
British Aluminium Co.'s Staff.
Sir T. Callender.
Mr. P. F. Rowell and Mrs. Atkinson.
President and Past Presidents.
Pipe-Majors Mackenzie, sen. and jun.

FIG. 9.—THE I.E.E. IN SCOTLAND.

The catchment area, 303 sq. miles in extent, lies to the immediate north of that of the Kinlochleven scheme. The average yearly rainfall is 73 in., and with a difference between the level of Loch Treig and the turbine nozzles of 742 ft., the continuous power capable of being developed in a year of average rainfall is 72,000 e.h.p., the maxi-

mum being 100,000 e.h.p. There will be a tunnel between Lochs Laggan and Treig 3.83 miles long and 17 ft. in diameter, and another between Loch Treig and Fort William 15 miles long and 16 ft. in diameter.

In the early afternoon the party entrained again for Fort William, at the base of Ben Nevis, 4,406 ft., where the night was spent.

On the final day of the meeting, Friday, June 2nd, the members embarked on the R.M.S. *Fusilier* and commenced a picturesque sail down Loch Linnhe and into Loch Leven, in the upper stretch of which the rock-hewn road from Invercoe to Kinlochleven came under notice. This road—a marvel of its kind—was constructed by German prisoners of war, and a monument, almost wholly made of tin cans and other refuse, erected at Duror by the Germans on the job to their fellows who died there, remains a striking example of German patience and ingenuity. The features of the way on to Kinlochleven are the narrowness of the loch and the ruggedness and precipitousness of the mountains, which are not really so high as tourists would imagine. Kinlochleven, where the works of the British Aluminium Co., Ltd., are situated, is a little town of about 1,500 inhabitants, most of whom are more or less dependent on the happy enterprise by which the company, taking advantage of Scottish water-power, has brought a large measure of prosperity to this remote Highland district. It is interesting to note that the maximum possible output of aluminium was maintained by the company without interruption throughout the war period. During the past 12 months the universal depression in the metal and most other industries has necessitated the temporary closing down of a considerable amount of the plant, but recently some of the plant was restarted, and the works are now operating at nearly full load.

The power-house, with its column of parallel pipes on the slope of the hillside, is the dominating feature of the landscape. It contains eleven large and two small generating sets; each set consists of a Pelton wheel and two d.c. generators on one shaft. The main turbines have a guaranteed efficiency of 80 per cent., each developing 2,900 b.h.p. at a head of 900 ft. and at from 300 to 400 r.p.m. They have two water jets, and on the majority of the machines the governors are of the hydraulic type and operate gun-metal spearhead valves; two of the sets have oil-controlled governing gear. While the latter is more sensitive it is also more complicated, and the more robust water governors are favoured for furnace work, for which very fine voltage regulation is not essential. The main generators are shunt-wound and have inter-poles and slot-wound drum armatures; the two generators comprising a set are connected in parallel, and the maximum output of each pair is 2,200 kW at 275 volts. Electrical regulation is provided to prevent flashing over, which might occur owing to differences in the currents flowing in the two armatures on one shaft. The field circuits are separate up to their rheostats, but have a common return in which is placed the cut-out; the latter is operated by two solenoids that break the field circuit when the terminal pressure rises to 350 volts, and the current solenoid is connected across the two leads of the same polarity on one pair of dynamos. It is adjusted in relation to the voltage solenoid so that an out-of-balance current short-circuits the field through a discharge resistance. The two small turbines are of approximately half the capacity of the main furnace sets; two generators of the compound-wound traction type are employed to feed the electric locomotives and the cranes on the wharves.

The extraction of aluminium provides an ideal load for a hydro-electric scheme, and the load at Kinlochleven is approximately 20,000 kW continuously night and day, the capacity of the plant installed being 35,000 e.h.p. The average annual rainfall is 77.22 in. and the actual head at the turbines is 935 ft. The catchment area is 62.3 sq. miles, and the area of the Blackwater reservoir is 4 sq. miles. The dam is 3,112 ft. in length and its height is 86 ft. The length of the main conduit is 3½ miles, and that of the pipe line 1¼ miles; the latter is composed of six 39-in. diameter pipes. The whole scheme is an example of how the resources of the Scottish Highlands can be utilised and much power that is at present running to waste be conserved.

The party was entertained to luncheon by the company, and later in the afternoon re-embarked on the steamer, which retraced its way down Loch Leven to Loch Linnhe, where the waters widen and the rambling mountains are a little less impressive than the ranges of jagged peaks further north, and so to Oban, where the final night of the tour was spent. On Saturday morning, June 3rd, the return journey south was commenced *via* the Oban and Callander line of the Caledonian Railway Co. By going one way and returning the other, a complete impression of the varied beauties of Highland scenery was made possible. The line to Loch Awe is cut out of the skirt of Ben Cruachan, and the system in use for the prevention of accidents owing to falling rock and boulders damaging the railway could be seen at this point. A series of protective wires is placed a few yards up the hillside from the railway, and when falling rock crushes them, the connecting signals are placed at danger, so that trains cannot proceed until the security of the line is assured. The device is used along all sections of the Oban line liable to be damaged in that manner.

Further on the magnificent view widens, and the Braes o' Balquhidder, lovely Loch Lubnaig, Callander (the Gateway to the Trossachs), Dunblane, the Banks of Allan Water, are passed in rapid succession. "East, west," says the Scots proverb, "Hame's best," and while appreciating that dictum, all who took part in the meeting felt that Scottish hospitality had made them at home in the Highlands.

It only remains, in conclusion, to express appreciation of the organisation of the tour; only those who assisted in that work can know the amount of labour that was involved. Mr. E. T. Goslin, chairman of the Scottish Centre, and particularly Mr. Joseph Taylor, the local hon. secretary and treasurer, are to be congratulated upon the success of the meeting.

THE RATING OF MACHINERY.

By JOS. J. H. STANSFIELD.

To those who are not conversant with Parliamentary procedure, and perhaps to some who are, it is difficult to understand why a Bill which has been introduced into Parliament seventeen times, passed its second reading nine times, and had the Ministers in charge of the department mainly affected by it in favour of it, should not have passed into law.

Such is the Parliamentary history of the Rating of Machinery Bill until this Session, when it has gone one stage further by having successfully passed the Standing Committee to which it had been committed.

The Bill is a two-clause measure. The first clause provides that when estimating rateable value for the purpose of local rates, in any hereditaments which may be used for trade, business, or manufacturing purposes, machinery shall not be included unless it is fixed or attached to the hereditaments. Clause 2 states what is meant by being fixed, or attached, machines, tools, or appliances being excluded if they are so fixed that they can be removed without necessitating the removal of any part of the hereditaments.

All machinery, machines, or plant used for producing or transmitting first motive power, or for heating or lighting, are specifically included, and if the Bill becomes law the manufacturer in England and Wales will in this respect then be treated as his brother manufacturers in Scotland and Ireland have been treated since 1902 and 1852 respectively.

Ireland had this advantage mainly from the Valuation of Ireland Act, 1852, whilst Scotland obtained the

benefit from an Act which was the direct outcome of a Royal Commission, appointed in 1896, and which, when reporting in 1901, recommended what will be carried out in 1922 if the Bill now before Parliament becomes an Act.

Following upon the Report, Scotland, with its usual keenness for business, immediately took steps to carry the recommendation into effect, which it was successful in doing the following year, and now England and Wales are suffering under a disadvantage not only compared with Scotland and Ireland, but also with every other country.

This is not the sole difficulty, for a comparison between one rating area and another shows that there is a great disparity in the extent to which machinery is taken into account for local rating purposes.

There is to-day greater activity on the part of Assessment Committees in the rating of machinery, and where there has been no rating in the past it is now proposed to make an assessment, in which case the manufacturer in such a locality will be to that extent handicapped in the race for business.

The makers of electrical plant and the suppliers of electricity are both concerned in the Bill. Where a manufacturer has decided to equip his mill or works with motors and to take a supply of energy from an outside source, but at the same time retain his steam plant for part use or stand-by purposes, he has had his assessment increased, and thereby increased his working expenses.

In the debate in the House of Commons on April 28th last, several examples were given of what the rating of machinery means to the manufacturer. A large engineering firm before the war was rated to the amount of £8,759, and was given notice by the Union Assessor that he intended to increase the percentage of capital value and machinery, and that for the future the firm would be rated to the extent of £47,673, of which 60 per cent. was due to the inclusion of machinery which would not have been rated in Scotland, Ireland, or abroad.

How differently manufacturers are sometimes treated in America! Cases were quoted where manufacturers were offered total exemption from local rating for from 10 to 15 years as an inducement to erect new works, and one case was mentioned where works were erected in America which were going to cost between one and two millions sterling and provide employment for from 500 to 1,000 men, the deciding point against their erection in England being the uncertainty with respect to the rating of machinery.

Very little opposition was advanced against a Second Reading of the Bill, the principal reasons for the opposition being, in the first place, that there were so many anomalies in rating that nothing should be done until the whole question was dealt with; and, in the second place, that no provision was made in the Bill to provide some alternative method by which the loss of rates could be made up.

The opposition of the National Conference of Assessment Committees was quoted, and their grounds of opposition deserve quoting in full. They say: "Among the reasons which led the Conference to pass such a resolution (opposing the Bill) were the following, namely:—(*a*) That machinery killed, crippled, and maimed, made widows and orphans, and created a public burden; (*b*) that it ought to bear its full share of the cost of those burdens; (*c*) that the use of machinery economised space, largely increasing the producing power of the works, reduced manual labour, cheapened the cost of production and augmented manufacturers' profits."

These grounds of opposition lead one to think that the Conference was for the nonce regretting the days of Good Queen Bess, for when the Poor Relief Act was passed in 1601 machinery, railways, telephones and telegraphs did not exist.

The real difficulty, however, is that a reduction of assessments in one direction must mean either an increase in another, or higher rates in the £. One of the fruits of the war has been an enormous increase in the costs of municipal administration and low rates per £ with high assessments are more easily defended than low assessments with high rates. Hence the keen search for hereditaments which will increase the rateable value.

A crying need of the day is to reduce municipal expenditure by all legitimate means, but whilst this is proceeding there is no valid objection to making an adjustment of the individual burden, particularly when the advantages claimed are a lessening of the handicap which the English and Welsh manufacturer has to face in his competition with manufacturers more favourably situated, assistance in the revival of trade, and a consequent reduction of the grievous burden of unemployment.

The Bill was left to the free vote of the House. The Minister of Health (Sir Alfred Mond) gave it his blessing, and it passed its Second Reading with a majority of 127 against an almost negligible minority of 17.

The future progress of the Bill will be watched with anxiety, in the hope that it will on this occasion be successful in passing through all its Parliamentary stages and receive the Royal Assent during the present session.

UNDERGROUND RAILWAY EXTENSIONS.

CONSTRUCTIONAL WORK COMMENCED.

ON Monday morning, June 12th, in the presence of a distinguished company, the inauguration of the programme of new work that is being undertaken by the London underground railway authorities took place at Golders Green, when Sir Philip Lloyd Greame, K.B.E., M.C., M.P., of the Overseas Trade Department of the Foreign Office and the Board of Trade, "cut the first sod" preliminary to the construction of an extension of the Charing Cross-Euston and Hampstead Railway, from Golders Green to Edgware. In connection with this extension further works will be carried out as follows:—(1) The provision of a projection between the Charing Cross-Euston & Hampstead Railway at its Camden Town station and the City & South London Railway at its Euston station. (2) The reconstruction of the City and South London Railway. The object of these works is to provide a through service of modern electric trains from Edgware to Clapham Common, thus bringing into being a much needed connecting link between North-West and South London, and more particularly a direct route between North-West London and the City.

A contract has been placed with Messrs. Charles Brand and Son for the construction of the line from Golders Green to Hendon, a distance of one mile and four furlongs. An intermediate station, as shown on the accompanying map, fig. 1, will be constructed at Brent. The new railway is to be mainly on the surface, and active preparations are already being made by way of clearing a pathway for the line. Owing to the pastoral nature of the ground, however, there will be comparatively little interference with the amenities of the district. The line will cross the River Brent by means of a viaduct 30 feet high. It is hoped to complete the line from Golders Green to Hendon by October 1st, 1923, and a through service of trains will then operate between Charing Cross and Hendon, and Moorgate and Hendon. Orders will shortly be placed for the reconstruction of the railway from Hendon to Edgware.

The accompanying map shows the district to be served and the path the new line will take. Between Hendon and Edgware there will be two further stations, viz., Colindale and Burnt Oak. The distances between the new stations will be as follows:—Edgware to Burnt Oak, .84 mile; Burnt Oak to Colindale, .90 mile; Colindale to Hendon (Central), 1.31 miles; Hendon (Central) to Brent, .67 mile; Brent to Golders Green, .96 mile; total 4.68 miles. The total length of the line from Edgware to Clapham Common will be 16.44 miles. As the line approaches Edgware it will run underneath the Great Northern Railway and also under the Midland Railway at Colindeep; at the Edgware terminus car sheds will be constructed. The extension to Edgware is scheduled to be completed by January 1st, 1924.

The contract for the work of connecting the Charing Cross-Euston & Hampstead Railway with the City & South London Railway has been placed with Messrs. John Mowlem & Co., and it is hoped to have the work completed by October 1st, 1923. The scheme, which provides for a six track underground tubular junction at Camden Town, will eventually permit a 4-minute service to be worked from Charing Cross to Edgware and Highgate, and also from Clapham Common to Edgware and to Highgate. These services having their

confluence at Camden Town junction will, therefore, involve a minute service of trains, or 60 trains an hour in each direction, which will constitute a record. The lay-out of the junctions, together with the signalling, has been the subject of a special traffic study. Flat junctions will be entirely eliminated, and where one line crosses another it will do so by "flying over" or passing under the other. This junction work will be carried out without any interference to the existing services now being run.

Regarding the reconstruction of the City & South London Railway which, as the pioneer of London's underground tube railway system, has served its purpose so well for 30 years, three contracts have so far been placed for the work: The Metropolitan Tunnel & Public Works Co., Ltd., will deal with the reconstruction of the line at Clapham Common and Clapham Road. Messrs. Perry & Co., Ltd., will deal with the reconstruction of the line between South Island Place and Stockwell, and Messrs. Charles Brand & Son will deal with the reconstruction of the line between Euston and King's Cross, and from King's Cross to the Angel.

The most important feature of the above contracts is the enlarging of the tunnels to permit of standard underground rolling stock of the latest pattern being used. The tunnels are now 10 ft. 6 in. in diameter, and this dimension will be increased to 11 ft. 8¼ in. The length of the up-to-date rolling

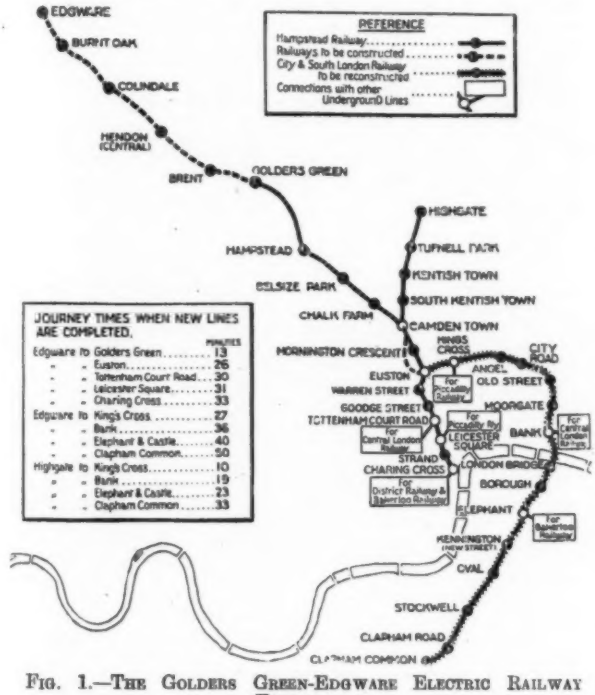

FIG. 1.—THE GOLDERS GREEN-EDGWARE ELECTRIC RAILWAY EXTENSION.

stock will also make it necessary for platforms at all stations to be lengthened. The reconstruction of the line between Euston and Moorgate is scheduled to be completed by October 1st, 1923, and escalators will be constructed at several stations, which will themselves be re-built on more modern lines. On August 9th, 1922, the line will be closed to traffic between Euston and Moorgate, August 8th being the last day of traffic operation. A full service of trains, however, will continue to run from Moorgate to Clapham Common. Passengers from stations south of Moorgate will still be able to reach Euston and King's Cross *via* the Elephant (Bakerloo) and Charing Cross, or *via* the Metropolitan Railway by changing at Moorgate Street. It is also anticipated that a special motor-bus service will be run from Moorgate and Euston.

One important effect of the completed scheme will be a great reduction in the journey time between North-West London and the City. The journey times will be as follows:—Edgware to Golders Green 13 minutes; Golders Green to Moorgate, 21 minutes; Golders Green to Bank, 22 minutes. Complete journey Edgware to Moorgate will be 34 minutes. Complete journey Edgware to Bank will be 35 minutes. The present journey time from Golders Green to the Bank, including the exchange at Tottenham Court Road, is 32 minutes and *via* Euston and C. & S.L. R., 32 minutes also.

On the City & South London extension the distance between Edgware and Clapham Common is 16.44 miles, and the running time will be 49 min. 40 secs., while the distance between Highgate and Clapham Common is 10.10 miles, and the running time will be 32 min. 40 secs.; the running time between Edgware and Charing Cross will be 33 minutes.

The "Passimeter" booking system that is in use at Kilburn Park, and has been subjected to exhaustive trial during the last six months, will be adopted on the remodelled stations on the C. & S.L.R., and the stations on the extension to Edgware. Thus the booking kiosks will be in a direct line with the entrance from the street, and passengers will proceed through the "Passimeter" to the trains without having to make the usual detour to the booking office, and without having to present a ticket at a barrier.

The contracts which have already been placed amount to £1,000,000. The cost of executing the whole schedule of works will be approximately £6,000,000 and when all contracts have been placed it is estimated that employment will be provided for some 20,000 people.

The extension of the railway to Edgware means the opening up of a new residential area, which it is anticipated will grow as rapidly as Golders Green, whose population in the last 20 years has increased by 67,000. The increase in passengers which has taken place at Golders Green station has risen from 1,600,000, in 1908, to nearly 12,000,000.

THE INTERCONNECTION OF A.C. POWER STATIONS.

DISCUSSION AT LEEDS

Mr. J. B. PALMER read the paper prepared by Mr. L. Romero and himself, on the above subject (an abstract of which appeared in our issue of March 3rd) at the NORTH MIDLAND CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS, on March 14th. Mr. Burnand occupied the chair, and there was a good attendance.

Mr. JUHLIN said that when the authors remarked that in running without an induction regulator the voltage might be seriously affected when at light loads, if the load came off the system, they, presumably, referred to the difficulty of controlling the wattless current which would flow. That point seemed to arise also when a regulator was in use, because the regulator was set for a definite boost, at a definite load. If the load suddenly came off one of the systems which was taking power, naturally, the drop in the inter-connector would vary and, unless the boost was changed, the wattless conditions would materially alter.

Referring to the booster diagrams which the authors gave, Mr. Juhlin said they would solve all the problems with the exception of that arising when a booster was not in use. He believed that under those conditions the problem, if tackled from the point of view of the total current, was indeterminate. He believed that by means of the simple diagram he put before them the problem could be solved under all its various conditions, with one exception, and that was when a booster was used at each end of the line. Under those conditions the problem was altogether indeterminate.

Mr. FURNESS observed that Americans appeared to charge for energy on two different scales—regulated and unregulated.

Mr. LONGMAN said the chief cause of hunting was undoubtedly in the prime mover. He had known cases when with a certain machine running at one end it was almost impossible to get settled conditions, but if the machine were off, all went right. That showed that they might have to pay a little more attention to the governor, but a thing like that was fairly easily got over. Another condition was that at times switching out certain feeders perhaps carrying a fair weight of load, or feeding into another connecting cable, set up oscillation. The case of two regulators, one at each end, was dangerous, unless they were sure that one person was going to control the operations of both.

Mr. JONES (Batley) had in view his own small station running in parallel with one of the Yorkshire Power Co. The bulk of their load was d.c., and they had very little difficulty on the whole. The Batley station was at 6,000, and the Y.E.P. Co. at 10,000 volts, and at the Batley end they did not use a regulator at all.

Mr. C. A. GILLING considered the case of several stations each interconnected electrically, but individually under the managerial control of the present undertakers—a position likely to obtain in some of the districts already delimited by the Electricity Commissioners. Unity of operation control was shown in the paper to be absolutely necessary, and the allocation of wattless current and its cost was a matter which might, or might not, be satisfactorily settled by agreement and disagreement between the parties concerned. How that control should be effected was another matter. Cases would arise in the near future when the interchange of power would range from small amounts up to 50,000 kVA or more. That meant several cables of comparatively large section in parallel at high voltages, with their corresponding transformers, and as the ratio of the reactance to the resistance would be high, no difficulties with regard to the synchronising capacity of the interconnecting lines should arise.

Mr. SPURR (Bradford) observed that there might be an advantage in putting down rotary converters in places where

they had to convert d.c. networks to a.c. distribution. The rotary converter was essentially a power-factor machine, and its influence on the power factor of a system would be very great. In Bradford the p.f. was in the neighbourhood of .93 in the working day, and they were fortunate in having 40 per cent. of their load converted to d.c. by rotary converters. It was going to be a point whether they should continue to use rotary converters or go over to three-phase distribution. His own opinion was that from generating station operating and transmission points of view the higher power factor would give better results. If it cost more for rotary-converter plant, it would probably pay them in the end.

Replying to the discussion, Mr. L. Romero said if they did not have a regulator they worked with unequal voltage, and they adjusted their permanent voltage variation, which was usually obtained by taps on the transformer, fixed to give them the most desirable factor at full load. When they were going out of parallel they dropped the load to zero, and they had practically no kilowatts flowing through the line, but they had a big wattless current. It was the breaking of the wattless current when the switch was actually opened that caused the trouble. He agreed that they would get a variation of the wattless current due to variation in load. That was the thing that the switchboard attendants would have to look after. He thought Mr. Juhlin's diagrams were an ingenious way of solving the whole problem. The authors thought that the mathematical solution was, generally speaking, more accurate. Mr. Romero was in favour of taking as many consumers off inter-connectors as could be found. Of course, the more consumers they took off the inter-connector the less interchange they had between power stations: it would simply be tantamount to two power stations feeding into one network. There would not be any actual interchange of current. Obviously, where they had a few small consumers tapped off the inter-connector they might have to stand a pretty large variation of pressure when the flow of current between the two stations was reversed from full load in one direction to full load in another. By making the reactance to the resistance ratio high they improved the power factor regulation under varying load with unequal fixed voltage and under certain favourable conditions this might turn out to be quite a good method of inter-connection, because it was so very simple. That could only be done between stations whose loads had a very high power factor.

Regarding whether d.c. supply from rotary converters would not be cheaper in the long run than l.p. three-phase distribution on account of the high power factor obtained with rotary converters, Mr. Romero did not think the extra cost of supplying at the lower power factor would balance the losses in the rotary converters and the cost of running rotary-converter sub-stations.

Mr. J. B. Palmer said that tapping interconnectors was general in America. The American companies ran mains primarily to inter-connect their systems, but he doubted very much whether they would do it if there were no prospects of picking up business on the way, because the distances were sometimes very large. How they would arrange the voltage regulation for very large powers he did not know, but it seemed that large stations would probably all be high load factor stations, and the possibility was that they would all feed into a control station, a nucleus of a star system, in which case they could get a great deal of voltage regulation on their generators without bothering about the effect at consumers' terminals. Even if large stations were hampered by the necessity of looking after their own networks, he should think that on a very large inter-connected system it would be absolutely necessary to run the most efficient stations at maximum load factors, and if there were no load variations there would be no need for any regulating apparatus.

Discussion at Birmingham.

The paper was read at the South Midland Centre of the Institution of Electrical Engineers on April 26th, when, in opening the discussion,

Mr. R. A. Chattock said that the authors dealt more especially with the theoretical requirements, and they had apparently overlooked the practical requirements, which were quite as important. He called attention to the practical difficulty of synchronising and interconnecting two loaded stations after they had become disconnected through any disturbance on the system. In Birmingham they had two large capacity stations and two stations of smaller capacity—all running in parallel on one system, and when two large sections of the supply were disconnected, in order to re-interconnect them, very great care had to be taken to get the two sides running in perfect synchronism before the connection was made, as, if not, a very heavy strain was likely to be thrown on the system at the moment of closing the interconnector. That was due to the inertia of all the plant running on circuit—both generators and motors—which had to be pulled into synchronism if the two sides were not exactly in step. Such a strain, if it occurred, was likely to set up a very heavy surge on the system, which would probably again open the interconnector. It was generally found necessary to have men standing by to throw in additional interconnecting cables directly the first one was connected, so as to give ample capacity in the link for dealing with a surge of reasonable dimensions.

Mr. W. Lawson stated that although the booster and transformer losses were probably small relatively, they should be included in the losses involved in the scheme of interconnection. The consideration of transmission losses raised the question whether they should be put down to generation or distribution. A method of ascertaining the transmission losses was to install at each station two watt-hour meters, one to measure the input and the other to measure the output, each meter having a ratchet and pawl attachment to prevent reverse registration. If the interconnector were used to supply feeders along its route the units delivered to the feeders would have to be metered and taken into account in computing the losses in the interconnector. Graphic recording instruments at both ends of the interconnector would be advantageous as affording a convenient means for watching whether the prescribed conditions of operation were being maintained.

Mr. W. Wilson pointed out an indirect advantage of interconnection which might be overlooked until actual working had brought it to light. The undertakings in this country were largely of municipal origin, instituted to supply the needs of a very limited area. The result had been that, in addition to their being on the whole comparatively small and inefficient, there had been a tendency not to see much further than the supply of street lamps, the lighting of the more accessible shops and dwellings, and such favourable motor loads as had come within the reticulation. Thus the cost of energy, even where it was easily available, was on the average much too high, the load factors were far too low, and the use of electricity was enjoyed by but a favoured small number of town dwellers. A policy of interconnection, by joining up separate stations into a combined system, would, in addition to its other advantages, bring the supply within the reach of many other less-favourably situated customers, with consequent improvement in those various respects. It was by the provision of power for the host of miscellaneous consumers situated away from the dense part of the town—such as brick works, flour mills, tanneries, dairies, and farms—that good load factors were secured. The two islands of New Zealand, each of which had a length approximating to that of the power area in the Western States, illustrated by one of Mr. Palmer's slides—namely, about 550 miles—were being equipped with generating plant in a series of large hydro-electric stations designed to be interconnected much in the manner described in the last appendix. The schemes were being laid out with that end in view, and already the advantages of a high load-factor had been experienced. There was no doubt, however, that harm had been done in the past by considering interconnection as a substitute for centralisation in the case of districts like the London area, which were supplied by a large collection of miscellaneous small stations. The improvement of the London supply by the institution of a few sets of large plant, in place of the extraordinary number of small ones that did the work in the past, appeared to have been considerably delayed by the recurring proposal to interlink the existing stations, an expedient which, according to the supporters of the proposal, would effect the same end. As a matter of fact, until the war the two schemes mutually conflicted, and neither was carried out, but there was little doubt that the result of joining together these heterogeneous sets of plant would have been chiefly to have increased the overhead charges without securing anything like a corresponding advantage. In the main, however, interconnection was a most important principle.

Mr. Rogers stated that the interconnection of generating stations belonging to the same authority and situated at no great distance apart offered no special difficulty, and was largely a matter of careful design of the interconnector and feeder system, with particular attention to sectionalising of the bus bars into groups, with graded reactances to minimise trouble under fault conditions. Transfer of load to meet changing conditions could be readily effected by voltage variation and adjustment of the steam supply to the generators, without the need of booster plant. The problem as it affected power stations belonging to different authorities and situated at considerable distances apart, was a different proposition. A study of the authors' Table I emphasised that the p.f. of the transferred load was one of the vital points to be determined. In the hypothetical case taken it would seem that to transmit the load at unity power factor the most economical condition so far as the interconnector feeder was concerned would make the position of the receiving station rather an unhappy one in so far as it had to deal with a huge wattless component. In such a case amicable co-operation by the authorities concerned would be necessary. If possible the combination of tie lines and interconnector feeders feeding into common sub-stations would be advantageous in most cases. Referring to the types of booster plant, he considered that the induction regulator, though expensive, was the best to adopt.

Mr. L. Romero, in reply, said that in his experience there were very few operating difficulties encountered in the parallel running of power stations. Perhaps the most serious of them was the breaking of the link when trouble occurred, due to the opening of one of the switches. It was very desirable whenever possible to arrange the switches on the intercon-

nector to open only for a fault on the tie line itself, or if overload protection was considered necessary it should be set very high, and given a considerable time lag. On grounds of economy he strongly favoured tapping interconnecting lines to supply load along the route. In the present state of development of booster apparatus the induction regulator was the best to adopt under most conditions, although it was obvious that, given satisfactory apparatus, the most economical method would be by tappings on the main transformer winding and the step-by-step switch. Mr. Lawson's suggestion with regard to metering was an excellent one. The paper took up the matter at the point where a case had been made out for interlinking after consideration of all pros and cons. They were by no means of opinion that interconnecting was a cure for all ills. The chief points in favour of it were economy in working, and reliability, and against those must be set the first and running costs of the link.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Isco C" Cut-out.

A new type of small house service cut-out has been introduced by Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C.2. This, the "Isco C" cut-out, illustrated in fig. 1, is designed for a working current of 10 A at 250 V. The case is of light cast-iron, finished in stoved green enamel, and provided with a brass earthing screw and clamping washers. The base is fitted with

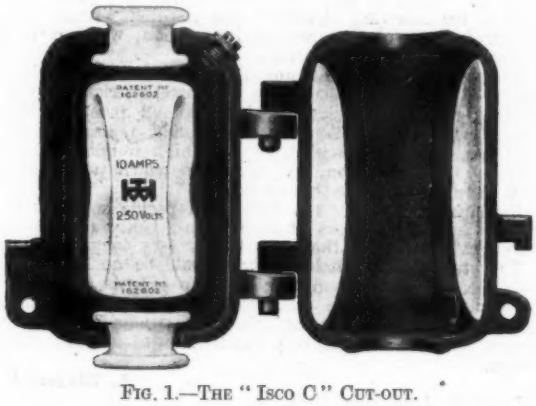

Fig. 1.—The "Isco C" Cut-out.

a pair of heavy solid terminals fitted with brass cheese-headed grub screws. The fuse carrier is of novel design. It is fitted with substantial self-aligning U-shaped contacts, and the asbestos tube through which the fuse wire passes lies transversely across the carrier in a deep groove. The method of threading the wire is shown in fig. 2. Another new feature embodied in the design is the slam catch, and the sealing device which saves a great deal of trouble. In a series of

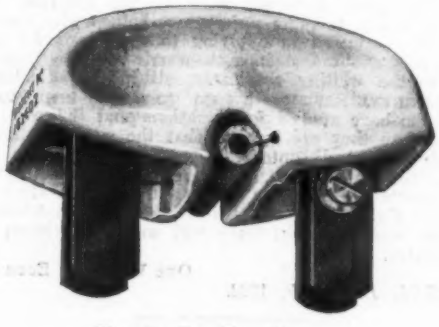

Fig. 2.—The Fuse Carrier.

tests carried out at the N.P.L., the positive pole of a 1,000-Ah, 240-V battery was connected to the top terminal of a cut-out, and also with a resistance of 0.100 ohm to the earthing screw of the case—the negative pole being connected to the bottom terminal. It was found that the fuse opened the circuit clearly without arcing, and the only adverse result was a superficial blackening of the asbestos lining of the lid.

The "Hydrautomat."

We were recently given an opportunity to inspect a novel method of raising water by the use of low-head streams, which, although possessing nothing of an electrical character, may conceivably be put into use for various purposes in steam-raising plants or other adjuncts of electrical engineering.

This apparatus, known as the "Hydrautomat," is the invention of Mr. Thomas Gaskell Allen, whose firm, Allen, Liversedge, Ltd., is well known in all parts of the engineering world. The most noticeable point of the system is its simplicity, which has been described as "ridiculous." It is entirely self-contained, providing its own motive power by natural means, and its only moving part is a sluice gate. A working example of the "Hydrautomat," erected upon the estate of Sir Samuel Barrow, is illustrated in fig. 3. The apparatus is arranged as follows: the lowest cylindrical tank seen in the illustration is closed and air-tight, with a pipe leading into it from the high level of a six-foot fall watercourse. This is the "operating chamber," situated about halfway between high and low-water level—in this case a

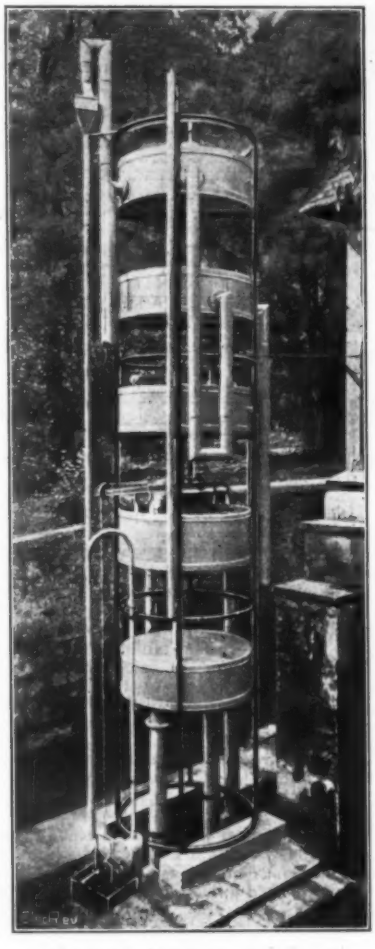

Fig. 3.—The "Hydrautomat."

fall of six feet. From this chamber there is also a discharge pipe to the lower level—the tailrace. Above the operating chamber, to the required height, is a flight of alternate closed and open tanks, which may be erected in a tower, as in the example, or in steps up a hillside. These tanks are interconnected by pipes, and in addition each of the closed tanks is connected to a "bus" air pipe running from the operating chamber. From the top tank, which is an open one, the water may be conducted to the point of application.

The apparatus has two strokes, pressure and suction. The pressure stroke is created by the inflowing of water to the operating chamber. The air in this is compressed and forced out along the air-conducting pipe to the closed tanks. The effect is to force out the water in these up to the next open tanks. At the end of this stroke the operating chamber and the open tanks are full of water, and the closed tanks full of air. Then the suction stroke follows. The contents of the operating chamber are discharged into the tailrace, and simultaneously the inlet from the headrace is closed automatically. This creates a vacuum in the chamber and closed tanks, which causes the water in the open tanks to be sucked up into the closed tanks above them, leaving the

latter full of water and the open tanks and chamber empty. The headrace inlet is then automatically opened and the cycle recommences. The pipes between the tanks are all water-sealed, so that all non-return valves or mechanical checks are dispensed with. The normal efficiency of the system is about 80 per cent. It will be seen that the principal use to which the "Hydrautomat" may be put is irrigation, although many other methods of employment will readily suggest themselves. It is of interest to note that only twice before in the history of hydrostatics has the principle embodied in this system been remotely approached. Hero of Alexandria, in the third century, and Giambatista della Porta, in the sixteenth century, made experiments in this direction.

The system, which has secured world patents, is being worked by the ALLEN HYDROSTATIC PUMP SYNDICATE, LTD., 106, Victoria Street, S.W.1.

"Genii P.S." Water Heaters.

A light, compact, and safe water heater is being manufactured by MESSRS. GEORGE NOBBS, LTD., 89, Cleveland Street, Fitzroy Square, W.1. This is known as the "Genii P.S." system—the "P.S." standing for "push system," so-called because the cold water entering the tank pushes heated water before it to the top of the tank, from whence it issues through an outlet pipe. The arrangement is shown in the drawing (fig. 4). The size of the tank and the electrical

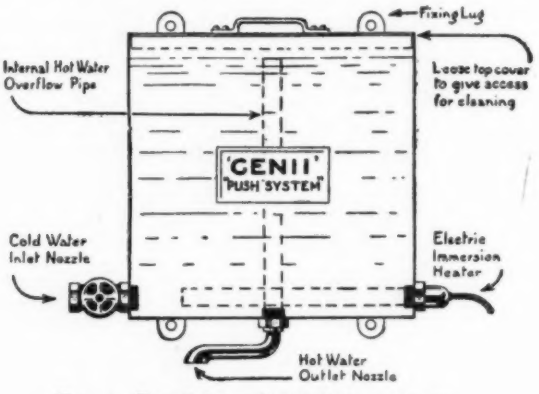
Fixing Lug
Internal Hot Water Overflow Pipe
Loose top cover to give access for cleaning
'GENII' PUSH SYSTEM
Cold Water Inlet Nozzle
Electric Immersion Heater
Hot Water Outlet Nozzle

FIG. 4.—THE "GENII P.S." WATER HEATER.

loading of the element depend upon the amount and temperature of the supply desired. Small quantities of boiling water can be obtained by the use of a small tank and a comparatively large element. If, however, continuous light loading is required the loading of the element may be fairly small and the tank large. The tanks are made in four sizes —10 pt., 20 pt., 5 gal., and 10 gal.—and each size is provided with a range of elements to suit practically any requirement. In most cases a three-heat switch can be fitted if desired.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The I.E.E. Summer Convention.

In commenting on Dr. Magnus Maclean's paper in your leading article of June 9th under the above heading you state:—

"Although these islands are not abundantly blessed so far as potential water-power resources are concerned we have a certain amount, which would, if developed, afford a considerable measure of relief to the continually increasing dearness of coal and growing scarcity of fuel," &c.

There is another side to the question, which is usually overlooked both by technical and non-technical writers on this subject. The best grades of coal mined in this country readily find a market for ships' bunkering, export, household purposes, manufacturing purposes, and steam raising. A critic inclined to split straws may change the order in which the various sources of outlet are stated, but the result is the same.

There is a ready demand in normal times for British coal for these purposes because of its admittedly high quality.

In sorting out the best grades of coal for the markets mentioned an appreciable quantity of small coal is left over; this coal is of low grade, because of the high percentage of incombustible it contains. It also follows that when the smaller coals are washed an appreciable quantity of small coal remains, and that this is also of low grade.

These low-grade fuels do not readily find a market, and the cost of mining and bringing such coal to the surface naturally remains to be added to the market price obtained for the saleable grades.

A great deal has been accomplished in the utilisation of these low-grade fuels for steam raising, and a tremendous field is available for further development in this direction.

It will be agreed by those in a position to judge that power developed from such fuels can be obtained in industrial areas at a price which water power in this country has no chance of competing against; and a second point is that the increased outlet for such low-grade fuels is likely to react favourably on the "dearness of coal and growing scarcity of fuel."

It is not too much to claim that there is no room for costly water-power schemes in remote districts in Scotland until the coalfields are exhausted for export and industrial purposes.

A. B. Muirhead.

Glasgow, *June 10th*, 1922.

[We agree with our correspondent to the extent that water-power development must be on an economically sound basis; it would be foolish to incur excessive capital outlay in this direction if energy could be produced to better advantage from fuel. We have also pointed out, time and again, that large electric power stations can utilise low-grade fuels which are useless for any other purpose, and therefore their erection is justified even if their thermal efficiency is low. But we cannot agree at all that water-power development should be deferred until the coalfields are exhausted, nor can we ignore the arguments regarding the social benefits to be derived from the production of energy in the Scottish Highlands, which have been so ably set forth by Mr. Newlands, Mr. Munro, and Prof. Magnus Maclean, and which form an essential part of the economic case for the projects in question.—EDS. ELEC. REVIEW.]

Broadcasting Wireless Telephony.

A £6 "wireless set" (in other words, a crystal set) is useless for receiving signals unless situated within a few hundred yards of the transmission station, when it is not connected to an outside aerial.

Only one person in an apartment house, boarding house, hotel, or flat will be able to use the outside aerial. The rest, if they wish to receive telephony at all must use indoor aerials with valve sets. There are other reasons, such as deafness, being surrounded by very high buildings, or extremely noisy situation, by reason of which a crystal set will in practice prove unacceptable.

Perhaps in assuming the number of people suffering from these various drawbacks at 50 per cent. I was on the high side, but in any case the proportion is very considerable.

To return to my analogy, there could be no lamp monopoly, because the carbon-filament lamp patents have mostly expired, but to people who wish to use indirect lighting, flood lighting, and the many other applications of high power lamps it would not be very much help to suggest carbon lamps.

A. Hinderlich.

Southall, *June 12th*, 1922.

"State Salary Required."

That which "A.M.I.E.E." complains about in his letter, published on the 9th inst., is only in keeping with the lack of business ability shown by a number of British employers. They are evidently so carried away with a sense of their own importance and greatness in the eyes of the world, that they do not think it necessary to supply the really essential details when advertising for men of ability and brains.

Another point I would raise is the extreme lack of courtesy shown to those unfortunate beings who spend time and postage stamps in applying to mandarins for employment; only about one in a thousand has the decency to reply to the waiting applicants, although the columns of the ELECTRICAL REVIEW are open to enable them to notify those who have applied for situations that the post is now filled. Then they are amazed that the workers show signs of distrust and discontent.

Clear out the Cuthberts and Percys and all other favourites of circumstances and give brains and ability a chance. By doing so they will enable Britain to regain that which she has lost, and no doubt trade will soon again boom in the old country.

One Who Has Been Had.

Sheffield, *June 12th*, 1922.

F.M. Earl Haig's Appeal.

I am greatly indebted to you for the leaderette in your issue of May 27th, and I feel it would be interesting and gratifying to your readers to know that the "Remembrance League" owes its creation to a well-known member of the electrical profession, and one of the oldest members of the Institution of Electrical Engineers, Mr. Arthur Berkeley, of the firm of Messrs. Berkeley & Young, Ltd.

Electrical engineers are proverbially an inventive and practical body, and the conception of the one day's service, upon

which the League is formed, is another sign that this imaginative and inventive genius—so needed in all enterprises—is still alive, not only for the benefit of your industry but also for those ex-Servicemen in distress in whom Earl Haig is so keenly interested.

While again thanking you for your valuable assistance, I trust that the above-named fact will ensure for me your further valuable aid, as well as the enrolment in the League of a large number of the electrical profession and those of the electrical industry.

W. G. Willcox, Capt.,
Organising Secretary, Appeal and Publicity Department, British Legion.

London, *June 7th*, 1922.

[We earnestly commend this admirable scheme to the notice of our readers.—EDS. ELEC. REV.]

Electric Furnaces.

We note in your last issue a letter signed "Adena," in which reference is made to a demonstration we gave at Newcastle. We thought that all electrical engineers were now aware that Wild-Barfield furnaces are specially designed for the correct heat-treatment of steel.

We, in common with other firms, have been favoured with "Adena's" inquiry, and in April last we informed your correspondent that we did not know of any maker in this country or abroad who could supply electric furnaces for smelting zinc. Neither the resistance nor the arc type is suitable. In spite of this, "Adena" continues to send out inquiries. Will it ease his mind to know that similar inquirers from numerous other sources have so far failed to discover any commercial method of electric zinc smelting? In the construction of such furnaces there are many difficulties to overcome.

It is probable, however, that in course of time we shall be in a position to tackle "Adena's" and other inquirers' problems of this nature.

Automatic & General Furnaces, Ltd.
E. P. Barfield, Maaging Director.

London, *June 12th*, 1922.

[Our correspondent seems rather hurt at "Adena's" persistence in the search for information; we, however, admire his tenacity, and hope it will be rewarded. The first step towards solving a problem is to formulate a clear statement of the case; and Mr. Barfield himself is hopeful of finding a solution.—EDS. ELEC. REV.]

We notice the letter in your current issue under the above heading, and if your correspondent "Adena" will kindly communicate with us, we shall be glad to discuss with him the question of supplying a furnace to meet his requirements.

It would probably save time if your correspondent could send us a sample weighing about 1 lb. of the zinc concentrate for laboratory test.

Bastian Electric Co., Ltd.
C. Orme Bastian, Manager.

London, *June 12th*, 1922.

[We have a communication for Mr. W. A. Chambers, whose letter on "Charging for Services" appeared in our issue of February 17th, 1922. Will he forward his address to this office?]

LEGAL.

CORONA LAMP WORKS, LTD.

A PETITION by the British Thomson-Houston Co., Ltd., for an order to wind up the Corona Lamp Works, Ltd., came before Mr. Justice Astbury in the Companies Winding-up Court on Tuesday. Counsel for the Corona Co. asked for an adjournment. He said the petition was the result of an appeal to the House of Lords from a decision of the Court of Appeal and a decision of Mr. Justice Sargant. There was a sum of £5,529 for costs, which was ordered by the House of Lords to be repaid by his clients. There was also a subsequent action, tried by Mr. Justice Astbury, between the same plaintiffs and defendants, and that resulted in judgment against the defendants. It was alleged in the petition that negotiations had taken place for a compromise on the different matters between the parties, and the matter was allowed to stand over for some scheme to be carried through. Unfortunately, while the negotiations were pending, the petitioning creditors put in an execution on the goods of the company. A receiver was appointed by the debenture holders, and the sheriff came out. Then this petition was launched. If the negotiations had been allowed to proceed, the Corona Co. had every reason to believe that there would have been no necessity for the petition, and a scheme would have been brought forward to satisfy everybody. The nominal capital of the company was £2,000, but there were debentures in three classes for £32,000; and the receiver was in possession. He (counsel) asked that the petition should stand over for a month to allow the negotiations between the petitioners and the company to be continued. They had a scheme in view with other people, and if it were carried out, satisfactory proposals would be made to the petitioners.

His LORDSHIP: You had better appeal to Mr. Turner.

Mr. WILLIS: I have.

Mr. TURNER said his instructions prevented him making any concession.

His LORDSHIP made a compulsory winding-up order.

SMART v. CORONA LAMP WORKS, LTD.

SIR FRANCIS NEWBOLT, one of the High Court Official Referees, on Tuesday had before him an application against the defendants for judgment in default of defence in respect of a claim for dilapidations of certain glass works at Brierley Hill, which had been rented by them.

Mr. BENNETT, counsel for the plaintiff, said that defendants had written to the plaintiff's solicitor saying that they did not propose to be represented at the trial.

Mr. HENRY JENNINGS, a surveyor practising at Brierley Hill, gave evidence to the effect that he had made an examination of the glass works in question for the purpose of seeing whether the covenants of the lease had been complied with, and he valued the work required to be done at £1,591 13s. 9d.

Sir FRANCIS, upon this evidence, gave judgment for the plaintiff for the amount stated by the witness.

BUSINESS NOTES.

Bankruptcy Proceedings.—AUBREY VICTOR CLAYTON, trading as "Clayton Motors," Park Lane Mills, Chorley Lane, Leeds, engineer.—The following are creditors:—

	£		£
Bowran (Robt.) & Co.	50	Sankey (Joseph) & Sons, Ltd.	1,493
Crofts, Ltd.	21	Smith, G. F., Ltd.	68
Coquantin, M.	27	Sterling Varnish Co.	38
ELECTRICAL REVIEW	24	Skefko Ball Bearing Co., Ltd. ...	38
Electrical Apparatus, Ltd. ...	383	Thompson & Watson	25
English, A.	18	Veno Co.	470
Gyclo Metal Co., Ltd.	19	Whitehead Bros.	23
General Electric Co., Ltd. ...	16	New Pelapone Engine Co., Ltd.	148
Harley Comeron, Ltd.	16	Spencer, P.	1,302
Illingworth, Albert	10	Bishop, E.	18
London Electric Wire Co. and Smiths, Ltd.	28	Downes, Commander A. B. ...	120
London Die-Cast Foundry, Ltd.	53	Elvy, Robb & Welch	275
Bankers	235	Farrar (G.) & Sons	16
Mica & Micanite Supplies, Ltd.	15	Owen Leslie	155
Peerless Engineering Co. ...	10	Regent Trust, Ltd.	33
Rhodes, Gill & Co.	28	Stone Bros.	14
Rostron (J.) & Son	50	Smith Bros., Ltd.	70
Eagland & Co., Ltd.	32	Trust Houses, Ltd.	45
Speight & Sons, Ltd.	16	Inland Revenue	48

JOHN NORMAN KEENAN, electrical engineer, 63, Queen Victoria Street, E.C.—Creditors under this failure met last Friday before Mr. F. T. Garton, Official Receiver, at the London Bankruptcy Court. It transpired that the debtor had recently been trying to induce friends to form a company with the idea of manufacturing ebonite. He came here from the U.S.A. in 1915, and obtained employment with various engineering contractors under the Ministry of Munitions. He also served in the R.A.F. until he was demobilised shortly after the Armistice, when he became manager of the ebonite and rubber department of an electrical works. Owing to subsequent unemployment, he resorted to moneylenders, and now owed £150, with no assets whatever. The failure was attributed to the debtor's inability to obtain employment. The case was left in the hands of the Official Receiver.

G. J. HOGG (F. Hogg & Co.), electrical engineer, 66, Waterloo Road, Smethwick.—Receiving order made June 2nd on debtor's own petition.

H. DOYLE (Accessories Supply Co.), 56, Hardman Street, Deansgate, Manchester.—First and final dividend of 9s. 1d. in the £, payable June 21st at the Official Receiver's Offices, Manchester.

R. S. MAGSON, 10, Stoney Stanton Road, Coventry, electrical engineer.—This debtor came up for public examination at the Coventry Bankruptcy Court on Monday. He stated that he commence dbusiness in 1912 with £20 capital and £40 he borrowed from his mother, which had since been repaid. His accounts now showed a deficiency of £213, and his failure was due to loss on contracts and illness. He had lost by other opeple failing. He realised his position last February, and the bank pressed him with regard to an overdraft. The bank held a

charge upon his interest under the will of his father and mother. He borrowed from a Mr. Franklin £130 to assist him against writs that had been issued against him. He also borrowed £80 from Mr. A. Magson. The examination was closed.

T. G. COATON, trading as T. G. Coaton & Co., 16, Humberstone Road, Leicester, electrical engineer.—The receiving order in this matter was made on May 29th on debtor's own petition. The statement of affairs shows liabilities of £2,331, while the assets are estimated to realise £1,056, from which preferential claims of £33 have to be deducted, leaving net assets of £1,022, or a deficiency of £1,309. Debtor attributes his failure to bad trade for the past two years, owing to the general slump, bad debts, depreciation in value of machinery and stock-in-trade, and ill-health of children. A private meeting of the creditors was held on March 31st last, when it was decided to accept a composition of 10s. in the £ payable by instalments, satisfactorily guaranteed. For the protection of the estate, debtor executed a deed of assignment. He was unable to carry the proposed composition into effect, and consequently filed his petition. Debtor states that in April, 1914, he and his brother entered into partnership and commenced business in Leicester as electrical engineers with a combined capital of £250, of which he contributed £50. In 1918 they were joined by another partner, who provided £100 capital. In the same year debtor's brother retired from the business, and in August, 1919, his other partner also withdrew and received £1,350 in repayment of capital. The usual books of account had been kept. Debtor became aware of his position early in the present year. First meeting June 16th at the Official Receiver's office, Leicester. Public examination July 7th at the Castle, Leicester.

T. CARTER, electrical engineer, 2, South Street, Dorchester, and High Street, Swanage.—Trustee: Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., appointed June 10th, 1922.

FRANK RAWCLIFFE, trading as Frank Rawcliffe & Co., 8, Nun Street, Newcastle-on-Tyne, electrical engineer.—The adjourned public examination of this debtor was held recently at the County Court, Westgate Road, Newcastle-on-Tyne. The statement of affairs showed liabilities of £7,026, of which £3,866 was expected to rank, and there was a deficiency of £3,855. Debtor attributed his failure to claims being made against him in respect of liabilities taken over by a limited company. He stated that he agreed to sell his business to a company which was registered on August 15th, 1921, with a nominal capital of £12,000 in £1 shares. It was agreed that the company should pay the liabilities, and debtor should receive £7,000 in shares and £3,500 in cash. After further questions the examination was adjourned.

Company Liquidations.—OLDHAM, ASHTON & HYDE ELECTRIC TRAMWAYS, LTD.—Meeting July 13th at 88, Kingsway, W.C., to hear an account of the winding up from the liquidators, Messrs. P. M. Rossdale and T. H. Underhill.

W. WATKIN & SON, LTD.—Winding up voluntarily. Liquidator: Mr. A. E. Quaife, 155, Fenchurch Street, E.C.

KEYNSHAM ELECTRIC LIGHT & POWER CO., LTD.—Winding up voluntarily, the undertaking having been disposed of. Liquidator: Mr. A. Collins, 28, Baldwin Street, Bristol.

RICKARD, WRIGHT & DEAN, LTD.—Winding up voluntarily. Liquidator: Mr. R. S. Dawson, Tanfield Buildings, Hustlergate, Bradford. Meeting of creditors, June 27th, at the offices of the liquidator.

EVERED & CO., LTD.—Winding up voluntarily. Liquidator: Mr. C. H. Smith, Phœnix Chambers, Colmore Row, Birmingham.

Dissolutions of Partnership.—DENHOLM, CRAIG & CO., electrical engineers, 81, Townhead Street, Hamilton.—Mr. Alexander Duncan has retired from the firm. The business will be continued by Messrs. J. G. Denholm & A. G. Craig.

REGENT ELECTRICAL INSTALLATION CO., 104, Whitechapel Road, E., and 17, Maddox Street, E.—The partnership between Mr. B. Barnet, Mr. M. Heller and Mr. R. Lederman was dissolved by the High Court on July 29th, 1921, and Mr. A. C. Heywood, of 14-15, Coleman Street, E.C., appointed receiver. June 15th was the last day for claims.

Trade Announcements.—MESSRS. OWEN & PALMER, electrical engineers, have taken over the business of Messrs. H. D. Carter (Bangor), Ltd., carried on at Faraday House, High Street, Bangor. Mr. Owen was manager for Messrs. Carter, and Mr. Palmer was formerly with Vickers, Ltd., and the General Electric Co.

THE CENTRAL LONDON ELECTRICAL CO has disposed of its Clapham branch, and is closing it on the 24th inst.

Catalogues and Lists.—THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—List No. 371, giving revised prices of fans catalogued in List No. 331. Also a priced and illustrated leaflet of combined switches and fuses and porcelain connectors.

MESSRS. ROSS, COURTNEY & CO., LTD., Ashbrook Road, Upper Holloway, N.19.—A pamphlet describing and illustrating a hydraulic lifting jack.

MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, W.C.1.—June stock list of d.c. motors ranging in size from 1 to 38 h.p.

ELECTRICAL COMPONENTS, LTD., 88-90, Great Charles Street, Snow Hill, Birmingham.—A comprehensive price list of wireless apparatus, including receiving sets, amplifiers, condensers, valves, &c.

ELECTRIC FIRES, LTD., King Street, Norwich.—Supplementary leaflets Nos. 2, dealing with immersion heaters for photographic purposes; and 3, advertising the "Peter Pan" double-purpose cooker. Illustrated and priced.

ECONOMIC ELECTRIC, LTD., 10, Fitzroy Square, W.1.—A well-illustrated price list of wireless apparatus, including complete receiving sets, amplifiers, head sets, condensers, inductances, relays, buzzers, switches, &c.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—June list (in French) of motors and dynamos in stock.

SWEDISH GENERAL ELECTRIC, LTD., 5, Chancery Lane, W.C.2.—List No. 42F, giving prices and particulars of "Century" oscillating fans; No. 111, stock list of d.c. and single-phase a.c. motors; and No. 111A, stock list of two- and three-phase a.c. motors, single-phase commutator motors, transformers, &c.

MESSRS. L. G. HAWKINS & CO., LTD., 116, Charing Cross Road, W.C.2.—A well-illustrated catalogue of "Universal" electric coffee mills, meat choppers and attachments. Also a leaflet giving prices of these.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C.2.—List W.L.3, giving illustrations, details, and prices of "Isco C" house-service cut-outs.

THE RELAY AUTOMATIC TELEPHONE CO., LTD., Marconi House, Strand, W.C.2.—An illustrated "souvenir" of the opening of the "Relay" telephone exchange at the Liverpool *Courier* and *Express* offices by Sir William Noble.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., Egyptian House, 170, Piccadilly, W.1.—A well-illustrated catalogue (No. 12E) of electric drills, grinders, buffing machines, spike drivers, &c. Also a leaflet (No. 78) describing an electric rivet heater, and a pamphlet illustrating and describing an oil rivet-heating forge.

PURIT SPECIALTIES, LTD., 27, Park Street, Birmingham.—An illustrated price list of electric kettles, hotplates, steam cookers, &c.

AUTOMATIC & ELECTRIC FURNACES, LTD., 281-283, Gray's Inn Road, W.C.1.—Heat Treatment Bulletin No. 30, "The Heat Treatment of Alloy Steels," describing the use of the "Wild-Barfield" non-magnetic point detector.

Unemployment.—The total number of registered unemployed on May 29th was 1,471,600, 42,657 fewer than in the preceding week. The number of workers on "short time" was also reduced by about 9,000, the figure being 111,000.

For Sale.—Halifax Corporation Electricity Committee invites offers for two Babcock & Wilcox water-tube boilers, complete with chain grate stokers, and one tandem compound steam water pump.

Mr. F. Rowland, the liquidator of the B.E. Co. (of London and Birmingham), Ltd., invites offers for the company's stock of electrical accessories, office furniture, fittings, &c., also the lease of 57, Upper Thames Street, E.C. (See our advertisement pages to-day.)

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates given below:—

Lucas. No. 418,346. Class 6. Dynamos, magneto-electric machines, and electric self-starters, all for use on motor-driven vehicles. No. 418,347. Class 8. Accumulators, ammeters, voltmeters fitted electric switchboards and resistances. Joseph Lucas, Ltd., Great King Street, Birmingham. May 31st, 1922.

Armature design. No. 421,389. Class 8. Accumulators, batteries, dry cells, cables, resistances, fitted switchboards, &c. The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C. May 31st, 1922.

Botrade. No. 424,268. Class 13. Electric fittings and accessories.—S. Bill & Co., Ltd., 146, Queen's Road, Aston, Birmingham. May 31st, 1922.

Batteries for Sale.—The City Accumulator Co., of 79, Mark Lane, London, E.C.3, has a stock of 20,000 Fuller Block-type accumulators (surplus Government stock) for sale at bargain prices for wireless sets.

Electric Lighting Sets for Commercial Motor Vehicles.—A special dynamo electric lighting set, known as the E.B.C., for use on commercial motor vehicles, has recently been introduced by the E.B.C. Electrical Co., Ltd., 62, Eagle Street, High Holborn, London, W.C.

The Cambridge Royal Show, 1922.—At the show of the Royal Agricultural Society, being held at Cambridge, from July 4th to 8th, Messrs. Ruston & Hornsby are showing in addition to a large collection of agricultural machinery and oil engines, small lighting and power sets, driven by petrol and paraffin engines.

The Import Trade of India.—H.M. Senior Trade Commissioner in India, in forwarding to the Department of Overseas Trade the March number of the Monthly Trade Returns of the Government of India, states that although there has been a considerable falling off in trade owing to the world-wide depression, and also to the enormous carry-over of stocks from the previous year, the United Kingdom has more than held its own in comparison with its principal competitors. The most noteworthy feature is, perhaps, the increase in the imports from Germany from 4.75 crores to 7.24 crores, the increases being mainly under the headings of dyestuffs, hardware, glassware, iron and steel, and the various miscellaneous articles of the bazaar trade in which Germany excelled before the war. The principal countries in order of importance contributing to India's imports are now the United Kingdom, Java (owing to increased imports of sugar), the United States, Japan, Germany, and Belgium.

The most remarkable feature of the year has been the prodigious import of machinery and millwork. In 1920-21 the total was 22.37 crores, but in the year under review this had increased to 34.25 crores, of which the United Kingdom supplied no less than 28.32 crores and the United States 4.51 crores. British shipments increased during the year by almost 11 crores, and American supplies by ½ crore. The principal increases were under the following heads:—

	1920-21. Rs. Crores.	1921-22 Rs. Crores.
Cotton machinery	3.67	7.64
Jute machinery	2.77	4.32
Electrical machinery	2.19	3.90
Boilers	1.59	2.55
Mining machinery	.30	.62
Oil crushing and refining machinery	.68	.54
Paper mill machinery	.32	.34
Rice and flour mill machinery	.55	.64
Sawmill and wood-working machinery	.18	.29
Sugar machinery	.17	.88
Shuttles	.14	.17
Miscellaneous machinery	4.13	6.40

The only serious competition in machinery at the present time is that from the United States, and, even in this case, the United Kingdom more than maintained its position. An increase in the imports from Germany from 17 to 55 lakhs should be noted. This consisted very largely of rice mill machinery and sugar plant.

The total imports of railway plant and rolling stock show a considerable expansion, from 14 to nearly 19 crores, of which the United Kingdom supplied 18.4 crores. In this enormous trade there is as yet very little competition, the imports from America in the year under review being only 13 lakhs. Imports from Australia, mainly sleepers, rose from 12.4 to 20.5 lakhs, while those from Canada fell from 20.75 to 2.14 lakhs. The expansion in this valuable trade may be expected to continue in view of the new capital expenditure programme on railways, which amounts to 30 crores per annum for five years.

The trade in electrical instruments and apparatus has been well maintained, the total imports in 1920-21 being 4.18 crores, as compared with 4.06 crores in the past year. Supplies from the united Kingdom show very little alteration, and are roughly 70 per cent. of the total (2.84 crores). American shipments were, however, reduced from 95 to 80 lakhs, while those from Italy rose from 7½ to 16¼ lakhs.

Riley Stokers at Gennevilliers.—Referring to the Riley stokers installed at the Gennevilliers power station of the Union d'Electricité, Paris, which was described in our issue of April 14th, 1922, the makers, Messrs. Fama (Soc. Anon.) inform us that each Riley stoker is assembled from 36 self-cleaning retort-units, arranged in two rows each 18 retorts wide, on an undivided archless furnace 30 ft. wide by 23 ft. deep; so that the entire area—690 sq. ft.—is covered by fuel in active combustion, the incandescent surface of the whole of the fuel bed radiating heat direct to the full length of the front tubes of the 5-drum Stirling boiler, which is guaranteed to produce 175,000 lb. of steam hourly. Each 36-retort Riley stoker has a capacity for burning twelve tons of coal hourly, and the fans can furnish 500,000 lb. of air hourly, the air for combustion being positively distributed by the tuyères of all the 36 retorts.

The company called "Fama" now possess an exclusive licence under the Riley patents to construct and install the well-known Riley stokers for Great Britain and its Dominions, as well as for France, and a British company will shortly be constituted by it. In the meantime, inquiries for Riley stokers should be addressed to Fama, 64, Mark Lane, London, E.C.3.

A Belgian Manufacturing Works.—The directors of the Société d'Electricité et de Mécanique (Procédés Thomson-Houston et Carels), reporting on the past year, state that an improvement in business took place in the autumn, and this continued on a larger scale in the new financial year; but competition, both in the Belgian home market and in export markets, was very keen, and orders could only be obtained by making large sacrifices. Thus the reduction in the sale prices of mechanical and electrical plant was from 30 to 50 per cent. as compared with the prices in 1920, and was by no means in proportion to the decreases in the prime costs. After several months of scarcely intense production of the first series of electric motors, the company from the beginning of 1921 had considerably to limit this output and begin as rapidly as possible the construction of all types of motors, alternators, generators, and transformers necessary to meet the requirements of customers. These new manufactures were quickly diminishing the extent of the deliveries from associated companies, and at the same time permitted the company better to meet competition, and the time was approaching when it would be possible to turn out at the Ghent works all the plant which it was of interest from an economic point of view to manufacture in Belgium. These manufactures were executed according to the calculations, drawings, methods, and processes of the company's allied interests—the American General Electric Co. and the French Thomson-Houston Co. As a matter of particular interest the report mentions the construction of an electric winding engine for the Limbourg-Meuse Collieries, which is the most powerful of its kind in Belgium, and it then deals with the business transacted in steam engines and Diesel-Carel oil engines. The accounts show net profits of 1,949,000 fr. for 1921, permitting of the payment of a dividend at the rate of 5 per cent. on the share capital of 36,750,000 fr.

Chinese Notes.—Towards the end of the year 1921 an electric-light plant was installed in town, says the *Hunchun Trade Report*, by a Chinese concern, with the assistance of two Russian mechanics. It supplies light for public and private use, and power is supposed to be also available for operating a flour mill and a sawmill. If successful, the venture may initiate an era of industrial development in the district.

The merchants of Nantungchow have organised an electrical company in Tienshen-kang, Nantungchow.

The Electric Light Co. of Anking, Anhwei is installing new plant.

It was decided by a stockholders' meeting of the Ta-Yu-Li Electric Co., of Hangchow, to establish tramways there.

A telephone system for the different districts in Kaifeng, Honan, will be established very soon.

The Yang Lu Electric Light Co., Kiukiang, Kiangsi, has extended its business.

Taihing, Kiangsu merchants recently organised an electric light company.

The Ming Hua Electric Bulb Factory will start work shortly.

The Tientsin Tramway Co., Ltd., plans to build two more lines—one from Kwanyinhou to the Central Station and the other from Peitakwan to the West Station. Work will soon be commenced.

An electric light company was recently organised by the merchants in Tehtsing, Chekiang.

The Ling Hu Tung Li Electric Light Co., of Huchow, Chekiang, has been granted a licence by the Ministry of Agriculture and Commerce.

The Pao Sing Electric Co., in Hupeh, was registered by the Ministry of Agriculture and Commerce.

The Peking Tramways Co. is entirely Chinese. Originally a concession was given to the Banque Industrielle de Chine, but on the representations of various public bodies, which reminded the Government that tramway undertakings are generally controlled by municipalities, the first agreement was superseded by a second, and this whittled down the concession to such an extent that the French bank was only given the privilege of appointing certain officials. The capital of the company was announced at $4,000,000, $2,000,000 to be subscribed by the Chinese public and $2,000,000 by the Government. Public subscriptions amounted to $2,000,000, so the first call was for $500,000 from the public and $500,000 from the Government. The arrangement between the Banque and the Government was that the latter's share of the capital should be furnished out of its credit with the Banque. However, the Banque suspended operations soon after the second agreement was signed, and left the Government to find the $500,000 unaided. There was a long delay before the money was forthcoming. Eventually the Ministry of Finance found the Government quota, and, as the necessary preliminaries had been completed, tenders were called. There are eleven directors in the company—six elected by the Government and five by the Chinese shareholders. One of the stipulations of the agreement between the Banque and the Government was that the Peking manager of the Banque Industrielle should have a seat on the board. That seat has been left vacant since the suspension of the Banque. The remaining ten directors—all Chinese—have met on numerous occasions, but the French bank representative has never put in an appearance, although nominally he remains a director. The company is governed according to Chinese law. Tenders for the supply of power plant, machinery, rolling stock and accessories, have been received from the following firms: Siemens (China); Innis and Riddle; British Electrical & Engineering Co.; Mitsui Bussan Kaisha; Arnhold Brothers; Jardine, Matheson; Anglo-French (China) Corporation; Compagnia Italiana d'Estreme Oriente; Chinese Commercial Corporation; Zedelius, Westphal & Co.; Sintoon Overseas Trading Co., Reiss and Co.; Wah-Chang Trading Co.; Liang Mao Trading Co.; Andersen, Meyer & Co.; and William Forbes & Co.

These tenders are now being examined by a commission of experts, who will make their recommendations in due course. The laying of the track is expected in the late summer.

Trade with Chile and Bolivia.—Mr. W. F. Vaughan Scott, who has been Commercial Secretary to H.M. Legation in Santiago, Chile, is at present in the United Kingdom pending transfer to another post, and will be in attendance at the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, until June 24th. He is prepared to interview firms interested in trade with Chile, and will also, if desired, furnish general information concerning trade with Bolivia. It is proposed that after June 24th he shall visit some of the important industrial centres in the provinces. Applications for interviews with Mr. Vaughan Scott should be addressed to the Department, and the reference 3808/TG/GP quoted. As a measure of economy in public expenditure, the post of Commercial Secretary for Chile was suspended as from May 1st.

New Belgian Company.—There has been formed at Samson (Maizeret) the Usine Hydroélectrique du Samson, with a capital of 1,000,000 fr., for the generation and supply of electricity and the manufacture and trade in accumulators and other electrical apparatus.

Book Notices.—"Train Lighting (Leitner System)."—In this little book, profusely illustrated and handsomely produced, full particulars of the Rotax train lighting system, with the latest modifications, evolved from the earlier "Leitner" system, are given. The latter has been used largely by the Great Western and other railways, since its inception, 17 years ago, and the teachings of experience are embodied in the present system, which employs the Leitner auxiliary-brush constant-pressure variable-speed dynamo, the Rotax-Leitner regulator and auto-switch, &c. Numerous diagrams and performance curves are included, as well as a large-scale set of curves showing complete cycles of battery charge and discharge pressure and current, which appear to be highly satisfactory.

"The Faraday House Journal," Summer Term, 1922. London: Faraday House.—This number contains numerous interesting personal notes; an article on the protection of alternating current systems, by R. W. Biles; a list of appointments secured by "Faradians"; and examination results.

Robertson's Universal Method for Export and Import Trade. By I. Robertson. Pp. 88. London: Scott Armstrong & Co. Price 2s. 6d. net.—This manual expounds a method of making quotations in foreign currencies which the author describes as "simple and universal," requiring no elaborate calculations, and saving much time. The essential feature of the method is the expression of values in terms of one particular coin (and decimals of that coin) for each country concerned; for instance, the penny is made the basis of calculation for all British values, the franc for French values, and so on. Consequently, for each pair of countries only one multiplier is required for the conversion of prices at a particular rate of exchange, and with the aid of tables of these multipliers covering the whole range of rates of exchange (published separately), the conversion of values is rendered a simple matter. The same principles are applied to units of length, weight, &c., and to prices per unit of length or weight in the various national systems.

Scientific Paper No. 434 of the U.S. Bureau of Standards. "Electromotive Force of Cells at Low Temperatures." Washington: Government Printing Office. Price 5 cents.—The practical importance of a knowledge of the behaviour of dry cells and storage batteries at low temperatures has arisen from their use at high altitudes and in Polar regions. This paper gives the results of tests carried out with the use of liquid air (−170 deg. C.), and carbon dioxide snow (−72 deg. C.B.). At the lowest temperatures high values of voltage were sometimes observed, and the polarity was often reversed.

"*Journal* of the Junior Institution of Engineers." Vol. XXXII, Part 9. June, 1922. London: Percival Marshall and Co. Price 2s.—The principal paper embodied in this number is "The Influence of Condenser and Choke Coil Protective Devices on Travelling Electric Waves," by S. Austen Stigant, A.M.I.E.E. The reports of local sections appear, together with abstracts of "lecturettes," &c. A report of the annual dinner is also included.

"Practical Engraving on Metal" (141 pp.). London: Percival Marshall & Co. Price 1s. 6d. net.—This monograph covers various phases of the art of metal engraving. Commencing with a short history of engravers and engraving, it passes to a detailed description of the necessary tools and the preparation of metal. The remainder is devoted to practice, and includes such work as heraldry, crests, monograms, Japanese work, lettering, gun-engraving, etching, stencil cutting, &c.

"Railway Electric Traction." By F. W. Carter. Pp. viii +412; figs. 204. London: E. Arnold & Co. Price 25s. net.

"Is Trade Unionism Sound?" By J. H. Bunting (98 pp.). London: Benn Bros., Ltd. Price 2s. 6d. net.—This is a second and cheaper edition of the work reviewed in our issue of September 23rd, 1921 (p. 405).

"History of the Telephone and Telegraph in Brazil." By Victor M. Berthold (92 pp.). New York: American Telephone and Telegraph Co.—This work gives an enormous volume of details of concessions granted by the State to companies and private individuals; the treatment is commercial rather than technical. Appendices give the full text of several decrees.

"Amateur Wireless," No. 1. Pp. 20, illustrated. London: Cassell & Co. Price 3d. weekly.—This is the first appearance of a weekly periodical which is to be devoted to the subject of wireless telegraphy and telephony from the amateur's point of view. The articles in the present issue explain in simple language such devices as the thermionic valve, crystal receiving sets, aerials, &c. Full instructions are given to enable the reader to make up a receiving set, and a competition, in which the prizes are receiving sets, is also instituted.

"Handbook of Commercial Geography." By G. G. Chisholm. Ninth edition. Pp. xvi+824, with maps and diagrams. London: Longmans, Green & Co. Price 25s. net.

"Model Electric Locomotives and Railways." By H. Greenly. Pp. 312; figs. 326. London: Cassell & Co., Ltd. Price 6s. net.

Outings.—On Wednesday, June 7th, the employés of the Woking Electric Supply Co., at the invitation of the directors, held their first outing. The male members of the staff, numbering some 50 men, were photographed and then started in two charabancs for Brighton. Weather conditions were perfect. There was a brief halt at Horsham "to cool the engines." After a cold collation at the Hove Cricket Ground Hotel, each man went whither his fancy led him, and the party rejoined the charabancs at the "Black Rock" for the run back to Woking. The ladies of the staff had their own outing in their own way in the form of a charabanc run to Southsea.

Amalgamation of Canadian Companies.—The National Electric Products, Ltd., has amalgamated with the Dominion Oxygen Co., Ltd., and the enlarged company has plans under way for a chain of branches at all important industrial centres in Canada. Plant is located at present in Montreal, Toronto, Hamilton, Merritton, Quebec, Shawinigan Falls, Welland, Windsor and Winnipeg. The Dominion Oxygen Co. is affiliated with the National Carbon Co. and the Prest-O-Lite Co., of Canada, two of the largest corporations of their kind. The undertaking is being carried out on a basis of exchange of securities.—*Reuter's Trade Service* (Montreal).

The Austrian Government Contract with the A.E.G.—The contract between the Austrian Government and the A.E.G., of Berlin, in connection with the sale of the great munition works at Wollersdorf, is for a period of fifty years, which may be prolonged. The capital of the Wollersdorfer Werke Co. amounts to 1,000 million kronen. The Federal Government will receive one-third of the shares representing Austrian capital, which must form at least 60 per cent. of the total capital. The works will operate principally for exportation without competing with Austrian industry, and in accordance with the Peace Treaty will cease manufacturing war munitions. The Government will receive 50 per cent. of the profits realised, and in addition one-third of the dividends distributed. The works will be handed over to the Allgemeine Elektrizitäts Gesellschaft in a few days.—*Reuter's Trade Service* (Vienna).

Dr. Rathenau's Policy.—If one is to speak of the policy of Dr. Rathenau, Germany's Foreign Minister, in the future, one must remind one's readers of his past activities. It is well known that Rathenau was of great assistance to Dr. Wirth even in the days when he was a private individual and head of the A.E.G. To-day Rathenau is responsible for the entire German foreign policy, which has found important practical expression in the Wiesbaden Agreement and the Rapallo Treaty. In the Wiesbaden Agreement he was supported by the majority of the German people and in the Rapallo Treaty by the entire nation. To read Rathenau's books is to recognise that he is a clever politician, and his past record proves that he is a first-class business man, for otherwise he could not have been the head of a huge organisation like the A.E.G. Such a combination—namely, the capacity of being a good business man and also a clever politician—is very rare indeed to-day in Europe, and it explains his success.—*Financial Times.*

The Berlin correspondent of the *Financial Times* suggests that the trade boom which is due to the low value of the mark, is about to end. He says that the big industrial concerns are building up the biggest possible reserves to meet disastrous times for Germany, which may lead to such a catastrophe as the world has never seen. With regard to Herr Rathenau, the writer says that the Wiesbaden Agreement has made him more popular than ever, and even his political enemies have supported him in the conclusion of this agreement, because his main object was to find some means to foster forgetfulness of war and to help Germany to recover the friendship of her neighbours. But how is it possible for those neighbours to forget Herr Rathenau's war-time warning that the next war must not start a year too soon?

The Cuban Market for Wire Products.—We have received from the Department of Overseas Trade a copy of a report by H.M. Chargé d'Affaires at Havana, on the market for wire and wire products in Cuba. On application to the Department in London information may be obtained of the principal hardware importers in Cuba, of local factories manufacturing articles from wire, and of mining companies operating in Cuba.

Swedish Electro-Mechanical Industry.—The report of the Swedish Electro-Mechanical Industry Co. states that after writing off 234,000 kronen for depreciation of stocks and doubtful debts, the year 1921 closed with a loss of 696,000 kr., most of which has been carried forward. Despite the depression it was possible for the company to increase the volume of the turnover, although the value of the latter did not quite reach that realised in 1920. The export trade, which was commenced last year, largely contributed towards the augmentation of the turnover, and the company's machines and transformers were now well introduced in the markets of Norway, Finland, Belgium, Spain, and Australia. During the new financial year it is intended to continue in the same direction and seek further to extend the export trade in order, thereby, to provide compensation for the reduced demand in the Swedish home market. The company delivered in 1921, 1,146 three-phase generators and motors of a total of 24,000 h.p. (2,200 of 19,200 h.p. in 1920), and 1,135 transformers of 40,000 kW (1,200 of 30,000 kW in 1920).

An X-ray Exhibition.—In connection with the Congress of Radiology and Physiotherapy, an exhibition of modern X-ray apparatus was held last week by Messrs. X-Rays, Ltd. As no supply of electricity was available at the official exhibition rooms, the firm arranged the show at its showrooms in order to be able to demonstrate the method of operating the various devices. Considerable interest was excited by the representative selection of the firm's manufactures exhibited.

LIGHTING AND POWER NOTES.

Algeria.—HYDRO-ELECTRIC SCHEME.—In order to meet the increasing demand for electricity for lighting and power purposes at the iron ore mines at Rouina, the Société des Mines Fer de Rouina is establishing a plant to utilise the water-power of the Kherba falls on the River Cheliff. Three sets of 400-h.p. turbines and generators have already been delivered, and are in course of erection. The power generated will be transmitted at 20,000 V a distance of 8¼ miles. At the steam-operated power station—which will serve as a stand-by when the hydro-electric plant is completed—a new 300-h.p. Diesel engine and alternator have been installed, bringing the capacity of the plant up to 630 h.p.

Australia.—NEW SOUTH WALES.—The report of the Chief Electrical Engineer of the State Department of Public Works (Mr. W. Corin) for the year ended June 30th, 1921, records a great deal of hydro-electric survey work. One of the principal schemes projected is the erection of a 15,000-kW station on the Murray River. Owing to the financial position it was found inadvisable to proceed with the Barren Jack and Nymboida developments, but a certain amount of preliminary work was carried out. The hope is expressed in the report that steps will be taken to form an Electric Power Commission, as the lack of such a controlling authority will, it is thought, lead to increasing difficulties and overlapping in the matter of electricity supply throughout the State. The action taken by other Australasian States is quoted as a guide to procedure. Amongst other recommendations are that Customs duties on imported machinery should be remitted, due regard being paid to the welfare of home industries; that the Sydney Council's plant should be improved to meet Government requirements; and that several applications for loans for electricity purposes made by municipalities should be granted.

Bangor.—YEAR'S WORKING.—There was a deficit on the working of the electricity undertaking of £668 during the past year.

Birkenhead.—LOAN.—The Electricity Committee has recommended the Town Council to apply to the Electricity Commissioners for sanction to the borrowing of £11,910 for electricity purposes.

Blackrock (Co. Dublin).—ELECTRICITY SUPPLY.—The Urban District Council has applied to the Ministry of Economic Affairs (Irish Provisional Government) for a special order under the Electricity (Supply) Act, 1919, authorising it to supply and distribute electrical energy for lighting and power purposes within the urban district.

Bolton.—LOAN.—Application is to be made to the Electricity Commissioners for sanction to borrow £3,500 for transmission lines, cables, and switchgear.

Burnley.—YEAR'S WORKING.—There was a surplus of £916 on the working of the electricity undertaking during the past year.

Carnarvon.—PLANT EXTENSIONS.—The National Electric Construction Co., which supplies the town with electricity, having called the Council's attention to the necessity for providing additional plant at an estimated cost of £8,000 in order to cope with the increased demand for electricity, the Electricity Committee has requested its consulting engineers to submit an alternative scheme. The present agreement expires three years hence, but provision exists for an extension of the period. It is anticipated that the cost of obtaining a supply of electricity in bulk from the North Wales Power Co. would be about £12,000.

Canterbury.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to the borrowing of £4,650, being excess expenditure in respect of new generating plant.

Continental.—FRANCE.—La Société de l'Union d'Electricité, of Paris, in conjunction with the Compagnie des Chemins de Fer de Paris-Orleans, has recently formed a new company with the title La Société d L'Union Hydro-électrique, with the object of establishing a generating station to utilise the water-power of the River Creuse. The plant, which will have a capacity of 40,000 kW, will be utilised to supply the power for the electric railway between Paris and Chateauroux.

Work is in hand on the erection of a new 10,000-kW turbo-alternator at the power station of the Compagnie Centrale d'Energie Electrique at Grand-Quevilly. Another set of similar capacity is also on order.

NORWAY.—According to the *Board of Trade Journal*, the committee appointed to inquire into the supply of electricity by a national plant to the whole of the country has prepared temporary recommendations as to the supply of energy to East Norway. The main source of power for this district will be the Nore station, the construction of which should be continued. The Raanaasfos station has been finished, but is not yet under full load. The Morkfos-Solbergfos scheme will be completed in 1924, and will yield about 40,000 kW. In addition, there will be about 20,000 kW available from Rjukan. This new power is comparatively expensive, and the general economic situation indicates that the demand for power will not increase to a great extent. Considerable new quantities of power can, however, be acquired at comparatively little cost by the regulation of the Glommen and Numedalslaagen—operations which call for a comparatively large staff of men, but do not require much in the way of material. A number of price reductions are proposed by the committee.

RUSSIA.—It is reported that the inauguration of the power station at Kaschiry, which is 62 miles distant from Moscow, took place last week. The station, which was commenced three years ago, is supplied with coal from the Moscow basin, and is the largest generating station in Russia.

BELGIUM.—During the past year the mains of the Société d'Electricité de l'Ouest de la Belgique have been increased from 325 km. to 458 km. The company is negotiating for further concessions in the area covered by the mains, while a new overhead line transmitting electrical energy at 50,000 volts, between Sweveghem and Renaix, has recently been completed.

Crewe.—PRICE REDUCTION.—The Town Council has reduced the price of electricity by 12 per cent., and has applied to the Electricity Commissioners for permission to run an overhead cable to Sydney.

Dumfries.—PROPOSED PURCHASE.—The Town Council has received the terms upon which the Electricity Co. would be prepared to transfer its undertaking to the Council, and the offer has been placed before the consulting engineer to the Council for investigation.

Hastings.—LOANS.—The Town Council has applied to the Electricity Commissioners for loans of £7,000 for mains and £5,418, excess expenditure on various works.

Edinburgh.—EXTENSION OF SUPPLY.—The Electricity Committee has recommended that the city mains be extended to Cramond village.

Kirkburton.—ELECTRICITY SUPPLY.—The Urban District Council has asked the Yorkshire Electric Power Co., Ltd., to submit a scheme for lighting the district with electricity.

Leeds.—LOAN.—Application is being made to the Electricity Commissioners for sanction to the borrowing of £200,000 for mains extensions for the next two years.

Leigh (Lancs.).—PRICE REDUCTIONS.—The Electricity Committee recommends that as from July 1st the prices for electricity be reduced as follows:—For lighting, 10 per cent.; for ordinary power and heating purposes, 15 per cent.; for a.c. supplies, 10 per cent.

Lincoln.—YEAR'S WORKING.—There was a deficit on the working of the electricity undertaking for the past year of £12,833.

Lyme Regis.—PROPOSED PURCHASE OF UNDERTAKING.—Col. Ekin held a Government inquiry on June 8th into the application of the Town Council for an order to enable it to purchase the undertaking of the Lyme Regis Electric Light and Power Co., Ltd. It was stated that the purchase price agreed upon was £3,750, and it was proposed to expend an additional £8,000 on extensions and improvements. The price charged by the company was 1s. per unit, and it was proposed to increase this to 1s. 2d., with a maximum charge of 1s. 6d.

Lytham.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing of £26,050 for electricity purposes.

Maidenhead.—PRICE REDUCTION.—The Town Council is reducing the charge for electricity for lighting from 10d. to 9d. per unit as from June 30th.

Newcastle (Staffs.).—YEAR'S WORKING.—The total revenue of the electricity undertaking (Engineer: Mr. A. J. C. de Renzi) for the year ended March 31st last was £8,697, as compared with £7,816 in the previous year. The total

expenditure (including £59 in connection with the North-West Midlands electricity inquiry) was £4,641, as against £5,295, leaving a gross profit of £4,056 (£2,521). The net result, after payment of capital charges, was a profit of £995 (£24). The total number of units sold rose from 303,145 to 325,501. The result from a small undertaking, as this is, was very satisfactory. We are informed that while the price of gas in the district remains at double the pre-war price, the average price of electricity is only 70 per cent. above the 1914 level.

Swansea.—YEAR'S WORKING.—The annual accounts of the Corporation electricity department show a net profit of £3,422 for the past year, as compared with £3,876 in the previous year.

Tonbridge.—PRICE REDUCTIONS.—The Urban Council has reduced the charge for electricity for private lighting by 2d. per unit, and for street lighting by 50 per cent., as from October 1st.

Woolwich.—YEAR'S WORKING.—There was a loss of £17,481 on the year's working of the electricity undertaking for the past year.

York.—LOANS.—The Town Council has applied to the Electricity Commissioners for loans of £1,200 for two air filters, £2,000 for transformers, and £3,000 for services.

TRAMWAY AND RAILWAY NOTES.

Algeria.—RAILWAY ELECTRIFICATION.—The railway connecting the mines at Rouina with the railway station is being electrified. Three locomotives of 66 h.p. have already been delivered.

Burnley.—TRACK RENEWALS.—The Tramways Committee has recommended the Town Council to apply to the Ministry of Transport for sanction to borrow £46,950, less £9,450 sinking fund contributions outstanding on work to be superseded, for track renewals.

YEAR'S WORKING.—The tramway undertaking shows a deficit of £2,314 on the working for the past year.

Canada.—ONTARIO RAILWAYS.—Agreements which seem to be finally completed for the purchase of the radial railways and electric power companies by the Province of Ontario and the city of Toronto from Sir William Mackenzie and his associates will require Toronto to assume obligations amounting to $30,000,000 (£6,000,000) and the Provincial Government $18,000,000 (£3,600,000).—*The Times.*

Colchester.—YEAR'S WORKING.—The annual report on the working of the tramway undertaking for the past year shows a net deficit of £3,200.

Lincoln.—YEAR'S WORKING.—There was a loss of £644 on the working of the tramway undertaking for the past year.

London.—CITY & SOUTH LONDON RAILWAY.—The section of the City and South London Railway between Euston and Moorgate will be closed for reconstruction on August 8th.

Ramsbottom.—YEAR'S WORKING.—The annual report on the working of the tramway undertaking for the past year shows a deficit of £1,765.

West Bromwich.—LOAN.—The Town Council has decided to apply to the Ministry of Transport for sanction to borrow £75,000 for the reconstruction of the tramway system.

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—NEW WIRELESS STATION.—M. René Corteil, principal of the wireless department of the Belgian Telegraph Administration, recently lectured before the Belgian Association of Engineers in Brussels on the projected inter-continental wireless station which the Belgian Government has decided to erect at Ruysselede for communication with the United States and the Belgian Congo. After having instituted an international competition, M. Corteil stated that the contract for the equipment of the proposed station had been awarded to the Société Indépendante Télégraphie Sans Fil, of Brussels, for the sum of 14,688,000 fr. The State would have to install the feeder lines and the telegraph and telephone lines, and these and other works would increase the total expenditure on the station to 20,000,000 fr. The station will extend over an area of 350 acres, having a length of 2,035 metres and a width of 700 metres. The antenna alone will cover 118 acres; and the power of 500 kW will be furnished either by one or two alternators.

India.—TELEGRAPH SERVICE.—At the end of March, 1921, the Indian telegraph system consisted of 88,417 miles of route, comprising 369,273 miles of wire, the increase during the year being 11,801 miles of wire or cable conductor. The number of offices maintained by the department throughout the country was 10,440.

POLICE WIRELESS.—The Madras Government has ordered seven wireless sets from the Marconi Co. for use in the rebel area of Malabar in conjunction with the auxiliary police, says the *Daily Mail.*

Japan.—WIRELESS TELEPHONY.—In order to relieve the congestion on the telegraph service between Tokio and Osaka, a plan is being considered by business men of the two cities for the establishment of a wireless telephone service between the two points, with Nagoya as the intermediate station. An application has already been filed with the Department of Communications for the establishment of a wireless telephone service between Osaka and Nagoya by the representative of the Daido Electric Motor Power Co., which is one of the promotors.—*Reuter's Trade Service* (Tokio).

South Africa.—AUTOMATIC EXCHANGES.—The Posts and Telegraphs Department will shortly install the first automatic telephone equipment in the public service at Camp's Bay. It is not a full automatic exchange, but is what is known as the community telephone switchboard, and provides means whereby new subscribers can be accommodated and also those on existing telephone lines through an automatic connection. Another installation is being put in at Pretoria. Preparations are being made for the installation of regular automatic exchanges in Port Elizabeth and Maritzburg, which will probably be put in hand within the next twelve months.—*South African Mining and Engineering Journal.*

The Telegraph Service.—TELEGRAM TRAFFIC.—During April last the number of telegrams which passed through the Central Telegraph Office, says *The Times*, was 3,600,000, the highest figure since July, 1921, when 3,625,143 messages were dealt with, and 660,000 more than in April, 1921. The instances of complaints of delay from all causes during April, 1922, were only eight. The number of telegrams received from subscribers to the telephone system during the financial year was 785,622, an increase of 49,859 over the corresponding period of 1920-21. The number of telegrams delivered by telephone was 663,754, or 2 per cent. less than in the previous year. The number of telegrams which passed through the cable room of the Central Telegraph Office was 9,324,825, as compared with 9,408,297 in 1920-21. Direct wires are now worked from the London Stock Exchange to Paris and Amsterdam, and have fully justified themselves. There was an increase of 11 per cent., or 1,116,218 words, in the traffic sent by the Imperial Cable, the respective figures for 1920-21 and 1921-22 being 9,885,640 and 10,999,858. The Central Telegraph Office is now carrying on wireless services to Berlin, Cologne, Posen, Rome, and Egypt. News handed in at that office is broadcast from the Post Office wireless station at Leafield, near Oxford, and is picked up in India and Australia, except when atmospheric conditions are unfavourable; a regular wireless news service is carried on with Halifax, Canada.

WIRELESS RATES.—A reduction in the rate for deferred wireless messages *via* Marconi from Great Britain and Ireland to the Eastern zone of Canada from 4½d. to 4d. per word is announced. It became effective from June 12th so far as messages handed in at Marconi offices in London are concerned, and at a date which will be notified in due course for messages handed in at post office counters throughout the country.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.—MELBOURNE.—Melbourne Tramways Board will shortly invite tenders for the supply of 60 single-truck electric tramcars, delivery to be spread over a period of two years.—*Reuter's Trade Service* (Melbourne).

PERTH (W.A.).—July 26th. Postmaster-General's Department. Telegraph and/or telephone apparatus, testing instruments, protective apparatus (sched. 734). (June 9th.)

WARATAH (N.S.W.).—July 31st. Commonwealth Steel Products Co., Ltd. One 300-kW rotary converter, complete with transformer, switchgear, instruments, &c. The manager.

Belgium.—June 28th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Telephone cables and accessories, also 1,847 metres of lead-covered paper-insulated cable; supply and erection of three central-battery telephone switchboards.

Chile.—SANTIAGO.—July 11th. Chilean State Railways. Structural steel for repairing bridges; insulated copper cable for welding purposes, voltage 440. Departamento de Materiales y Almacenes, Almada station, Santiago, Chile.*

Ilford.—July 10th. Electricity Department. Mechanical stokers for two Marine Dryback boilers. (See this issue.)

India.—June 23rd. High Commissioner's Department. Switchboard cable and cable for wiring buildings, dry-core lead-sheathed and armoured cable, and lead-sheathed unarmoured submarine cable. (June 2nd.)

Kirkcaldy.—July 10th. Electricity Works. Converting plant, specification No. 2. (See this issue.)

London.—L.C.C.—July 15th. Wiring of the buildings, motors, telephones, and supply and fixing of overhead electrical conductors and main cables, switchboards, &c., at the Eleventh Mental Hospital, Epsom. (June 9th.)

MILE END.—Board of Guardians. Two 300-A switchboards, motors, &c., for the Bancroft Road institution. (See this issue.)

H.M. OFFICE OF WORKS.—July 4th. Electrical and/or mechanical engineering labour-in-daywork in Manchester. (See this issue.)

Manchester.—June 28th. Electricity Committee. Installation and connection complete of the subsidiary cables between generators, auxiliaries, transformers, and switchboards in the Barton power station, with materials for fixing tail end boxes and potheads for all the cables scheduled. (June 2nd.)

June 21st. Electricity Committee. Stores for six months. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester.

Middlesbrough.—June 26th. Town Council. Construction of double line of tramways. Borough surveyor.

Nottingham.—July 3rd. Board of Guardians. Installation of an electric clock at the Bagthorpe Institution and infirmary. (See this issue.)

Preston.—June 28th. Electricity Department. E.h.p. switchgear. (June 2nd.)

Reigate.—June 27th. Town Council. Diesel engines and single-phase alternators, complete with accessories, two steel oil storage tanks, one 12-ton overhead electric travelling crane, alterations to existing cast-iron water tank. (June 9th.)

Salford.—July 3rd. Electricity Department. E.h.p. and l.p. switchgear and transformers for the Agecroft power station. (See this issue.)

South Africa.—CALEDON, CAPE PROVINCE.—August 9th. Municipal Council. Electric lighting installation. The specification has been drawn up by Prof. Bohle, of the University of Cape Town.

ROBERTSON.—August 14th. Town Council. Two 75-kW steam sets and accessories; one 300-Ah battery; material for distribution, &c.*

Southend-on-Sea.—Electricity Department. One 480/550-V, d.c. generator, with 500/550 shunt regulator, to be direct coupled to a prime mover; also one 480/550-V, d.c. generator, 600/650 kW, to be direct coupled to a prime mover, both generators to be of the multi-polar type. (June 9th.)

Tynemouth.—June 26th. Electricity Department. A.c. booster. (June 2nd.)

Warrington.—June 20th. Board of Guardians. Electrical goods for three months. Mr. A. Bottomley, clerk, Bewsey Chambers.

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia. — MELBOURNE. — Electricity Supply Committee. Accepted :—

House cut-out boxes (£273).—Tombs & Howcroft.
Incandescent lamps (£872).—Lawrence & Hanson Electrical Co.
6,600-V split conductor switchgear (£1,316).—Metropolitan-Vickers Electrical Co., Ltd.
6,600-V switchgear (£4,700).—Ferguson, Pailin, Ltd.

Town Hall and Baths Committee. Accepted :—

Motor generator for use in connection with bioscope entertainments (£245).—Warburton Franki, Ltd.

LITHGOW, N.S.W.—Town Council. Accepted :—

Installation of electric light distribution system (£2,518).—Ramsay, Sharp and Co.

SYDNEY, N.S.W.—Electricity Supply Committee. Recommended :—

Centrifugal circulating pump (£1,000).—English Electric of Australia, Ltd.
Ash-handling plant for four new boilers (£9,188).—Underfeed Stoker Co., Ltd. & H. Perks.—*Tenders.*

Belgium.—Ten concerns—six Belgian and one each Italian, French, German, and British, the last being the British Insulated and Helsby Cables, Ltd.—submitted tenders recently to the municipal authorities of St. Gilles-lez-Bruxelles for the supply of 4,000 metres of armoured cable and 2,000 metres of telephone cable, together with the necessary accessories. The tenders ranged from 92,361 francs to 186,551 francs, the lowest being that of the Corvillain Co., of St. Gilles.

Blackpool.—Gas Committee. Accepted:—

Supply of electricity controlling gear at the gasworks.—Thos. Barton.

Bolton.—Accepted:—

Installing electric hoist at new premises being erected in Great Moor Street.—Messrs. Grundy & Co., Bolton.

Bradford.—Tramways Committee.

20 tons brake shoes (£245).—Cole, Marchent & Morley.

Electricity Committee.

E.h.p. switchgear for two 1,500-kW motor converters at Bolton Road substation.—Reyrolle & Co., Ltd.
D.c. switchgear for two 1,500-kW motor converters.—Bertram Thomas.
Supply and erection of one 150-kVA special testing transformer.—English Electric Co., Ltd.
Supply and erection of transformer chamber at premises of Downs, Coulter & Co., Ltd.—Robert H. Rae.
Supply and erection of transformer chamber at premises of Pepper, Lee and Co., Wyke.—F. G. Burgess.
Control gear for a.c. motors for No. 4 boiler-house at Valley Road station.—Metropolitan-Vickers Electrical Co., Ltd.
600 single-phase alternating-current house service meters.—Landis & Gyr, Ltd.
Erection of overhead line from transformer chamber in Thornton Road to York Street.—British Insulated & Helsby Cables, Ltd.

Board of Guardians. Accepted :—

Laying electric power cable for the cold stores.—Smith & Croft.

Canterbury.—Town Council. Accepted: —

Dust destructor (£1,395).—Meldrums, Ltd.

Folkestone.—Town Council. Accepted:—

Installing electric light in the administrative block at the Sanatorium.—Folkestone Electricity Supply Co.

Glasgow.—The Electricity Committee recommends the purchase of 240,000 tons of coal for delivery over 12 weeks, at a price which shows a reduction of about 10s. per ton on that paid during the financial year just ended, representing a saving of £120,000 in the coal bill.

Corporation. Recommended :—

Plant required at the Provan Chemical Works :—
One 60-h.p. totally-enclosed motor.—Bruce Peebles & Co., Ltd.
One 10-h.p. ditto.—McFarlane Engineering Co.
One 15-cwt. electric-driven lime and ash hoist.—John Bennie, Ltd.
Belt conveyor for lime sludge.—Ritchie-Atlas Engineering Co.
Electric crane for electric locomotive shed at Provan gas works, Glasgow (recommended).—**Paterson Hughes Engineering Co., Ltd.**
Electric lighting work of Blackfriars Church (£2nd).—Walter Weir.

London.—STEPNEY.—Electricity Supply Committee.

One 50-ton electrically-driven overhead travelling crane for the Limehouse generating station, spare parts and accessories, and the dismantling of the existing 20-ton hand-operated crane and re-erecting it at the Mile End sub-station :—

	£
Ransomes & Rapier, Ltd. (accepted)	3,455
Carrick & Ritchie, Ltd.	3,673
Wellman Smith Owen Engineering Corporation Ltd. ...	3,741
J. Carrick & Son, Ltd.	3,799
Heywood & Co., Ltd.	3,928
S. Butler & Co., Ltd.	3,935
A. Jack & Co., Ltd.	4,000
Chatteris Engineering Co., Ltd.	4,047
Sir W. Arrol & Co., Ltd.	4,097
Babcock & Wilcox, Ltd.	4,280
H. Morris, Ltd.	4,320
Stothert & Pitt, Ltd.	4,360
J. M. Henderson & Co.	4,383
Broadbent & Sons, Ltd.	4,414
Higginbottom & Mannock, Ltd.	4,611
Butters Bros. & Co.	5,355
Sir W. G. Armstrong, Whitworth & Co.	5,671
Isles, Ltd.	6,200

Circulating water pipes for Limehouse station :—

Perry & Co. (Bow), Ltd. (accepted)	2,134

Converting plant at sub-station :—

Motor converters.	
General Electric Co., Ltd. (recommended)	10,114
Ateliers de Constructions Electriques de Charleroi ...	10,930
Ditto ditto (alternative)	11,435
Bruce Peebles & Co., Ltd.	12,081
Mather & Platt, Ltd.	15,242
Ditto ditto (alternative)	15,743
Rotaries.	
English Electric Co., Ltd.	10,569
Ditto ditto (alternative)	10,641
Ditto ditto (alternative)	11,169
Ditto ditto (alternative)	11,625
Metropolitan-Vickers Electrical Co., Ltd.	11,165
Ditto ditto (alternative)	11,429
Ditto ditto (alternative)	11,577
Ditto ditto (alternative)	11,812
Ditto ditto (alternative)	11,895
Ditto ditto (alternative)	12,084
Ditto ditto (alternative)	12,282
Ditto ditto (alternative)	12,547
British Thomson-Houston Co., Ltd.	11,371
Ditto ditto (alternative)	11,965
General Electric Co., Ltd.	11,502
Ditto ditto (alternative)	12,456

Coal :—

Two barges Scotch washed peas (24s. 6d. per ton).—J. Hudson & Co.

25 cast-iron pavement boxes, frames and covers.—E. & F. Wright (accepted).
One mile each B & C troughs and covers (£452).—Sutton & Co. (Overseal), Ltd.

South Africa.—PORT ELIZABETH.—City Council. New electric power plant. Accepted :—

Turbo-alternator (£16,200).—Sykes & Co.
Circulating piping (£1,429).—Sykes & Co.
Boilers and hoppers (£26,108).—Reunert & Lenz.
Steam pipes (£2,111).—Reunert & Lenz.
Overhead crane (£1,435).—Sykes & Co.
E.h.p. switchgear (£885).—British General Electric Co.
E.h.p. cables (£2,355).—Henley's Telegraph Works Co., Ltd.
Two 500-kW converters (£5,050).—Bruce Peebles & Co.
Bunkers and belt conveyers, circulating water intake and delivery stand pipe and base and railway culverts (£10,313).—Murray & Stewart.—*South African Mining and Engineering Journal.*

A Committee of the Council reports, with regard to section c (part 2), for concrete circulating-water pipes, that none of the tenders submitted was suitable. It recommends the Council to call for fresh tenders for cast-iron pipes.

Wolverhampton.—Electricity Department. Accepted:—
Fittings and mountings for Nos. 3 and 4 boilers (£684).—J. Hopkinson and Co., Ltd.
Automatic feed-water regulators (£195 and £79).—Crosby Valve & Engineering Co.

Tramways Committee. Accepted:—
Construction of tramway track in Waterloo Road (£3,872).—Eadie, Towers and Co.
Welding joints of the new track, &c.—Rail Welding Co., Ltd.

York.—Town Council. Accepted:—
Rotary converter, switchgear, &c. (£2,753).—British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, June 17th. At 2.45 p.m. Visit to the works of the Carborundum Co., Ltd., at Trafford Park.

Incorporated Municipal Electrical Association.—Tuesday, June 20th-Friday, June 23rd. At Wolverhampton. Annual Convention.

Institution of Railway Signal Engineers.—Wednesday, June 21st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 3 p.m. Paper on "Light Signals," by Messrs. H. E. Fawkes and W. J. Sadler.

Tramways and Light Railways Association.—Thursday and Friday, June 22nd and 23rd. At Bournemouth. Annual Congress.

Physical Society of London.—Friday, June 23rd. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of:—
"Pointite" fire cement for use on boiler settings.
Lineys patent floor board raisers used by wiring contractors.
Recording voltmeter No. 62,251 M-C with 24-hour charts. Two ranges, 300/600 volts, and purchased between 1909 and 1912.

NOTES.

G.P.O. Outing to Windsor.—The G.P.O. Engineering Department (Designs Section) held their seventh annual outing on June 10th. The party were conveyed in motor charabancs to Windsor *via* Slough and Eton, arriving in time to see the start of the Marathon race, after which the Round Tower was ascended and the surrounding twelve counties duly inspected. The North and East Terraces and St. George's Chapel also claimed attention, but the State apartments were unfortunately not accessible. The party, 64 in number, then partook of tea, were photographed in the usual group, and after a ramble by the river returned to town *via* Egham and Staines.

Coal Pile Fires.—According to Mr. J. E. Williams, in a letter to the *Electrical World*, the secret of preventing coal piles from catching fire by spontaneous combustion lies in the manner of building up the piles. Two simple rules that, if followed, will go a long way to prevent fires are: (1) In unloading coal with buckets drop the load in a bulk. Don't let it trickle out into cone form. (2) Build the pile in flat layers. Drop the first load flat in a bulk, lay the next load close to the sides of it, the next to the side of that, and so on until one layer is completed with a flat top. This keeps the mixture of fine and coarse coal together.

If the coal is dropped from the bucket in cone shape, the heavier coal rolls down the sides of the pile, leaving the fine coal in the peak. The cones that are formed will have the heavy coal at the bottom and sides, through which air will enter and may set the whole pile on fire. By building the coal pile in layers this separating of the fine coal and of the larger pieces of coal is prevented, and the air will not filter through so easily. Once the coal pile is built for storage, rehandle the coal as little as possible. For use take a layer off the top and build up as before, not forgetting that the secret lies in keeping the surface flat and avoiding internal cones.

American Radio Installation Rules.—The Bureau of Standards, Washington, U.S.A., has prepared a circular containing the recommendations of a committee of the National Board of Fire Underwriters for the revision of Rule 86 of the National Electric Light Code, covering wireless installations, together with a discussion and explanation prepared by Bureau of Standards engineers. The recommendations (LC 62) are promulgated in order to produce field experience to substantiate the wisdom of the proposed rules before their final incorporation in the 1923 edition of the National Electrical Code. No authority is given to suspend or replace the present Rule 86 of that code, but the recommendations are issued for the information of inspection departments having jurisdiction over the application of the code.

Appointments Vacant.—Assistant meter engineer, 400 taels per month, meter department assistant, 300 taels per month, for the Shanghai Municipal Electricity Department (tael=3s.); shift engineer, for the St. Helens Corporation Electricity Department. (See our advertisement pages to-day.)

Radium Research.—At a meeting of the Governors of the London Hospital, on June 7th, it was announced that at the request of the Medical Research Council of the Ministry of Health, the Committee had consented to the carrying out of organised research into the action of radium, both as to its benefits and dangers. The work would be undertaken by Dr. Sequeira, Mr. Gordon Luker, and Prof. Turnbull.—*Westminster Gazette.*

Educational.—CITY AND GUILDS OF LONDON INSTITUTE.—The Report of the Council for 1921 has been published. The total number of students is given as 609, as compared with 587 in 1919-20. One hundred and fifteen students entered for the Final (Internal) B.Sc. (Eng.) degree examination of the University of London; 88 passed, 19 with first-class and 24 with second-class honours. Details of other degrees and awards are given in the report. The general income and expenditure account shows an excess of expenditure over income of £1,464. Other information given includes a record of social events, changes of *personnel*, gifts of books, &c.

FINSBURY TECHNICAL COLLEGE, Leonard Street, E.C.2.—The next entrance examination will be held on September 19th. Forms can be obtained from the Registrar. The programme of the College is under revision, and will be issued shortly. (See our advertisement pages to-day.)

The New Electrical Phenomenon.—The discovery made by two Danish engineers, Messrs. Johnsen and Rahbek, has recently been applied by Messrs. Erich F. Ruth, of Berlin, to the construction of a number of remarkable instruments and apparatus.

The discovery referred to is the fact that if a lithographic stone coated with tin foil is connected to one of the terminals of an electric circuit, the other terminal of which communicates with a metal plate, a continuous current is found to flow through the stone, which clings firmly to the plate. An extremely small current is sufficient to ensure this attraction, which disappears on opening the circuit. One experiment showed the power expended to retain a weight of 5 kilograms to be less than one-tenth watt. Amongst other applications of this discovery Messrs. Ruth have used it in a *call relay* of extreme sensitiveness actuated by a current of one-millionth ampere. This relay is put to a multitude of uses, of which a few may be mentioned.

On an experimental line in the Berlin neighbourhood, Messrs. Ruth have developed radio-telephony based on the use of the relay to such perfection that any subscriber to the Berlin telephone system may put himself into communication with any traveller in the train or *vice versa*. Electrical waves of moderate length and small energy are generated at one of the terminal stations and transmitted to conductors serving for ordinary telegraphy or telephony along the railway track.

On the roof of one or more of the cars is a low aerial connected with a small wireless telephone sender, the same aerial serving simultaneously for talking and listening. The traveller uses an ordinary telephone. Inasmuch as the electric currents from the local telephone system at the railway terminus where they enter the line are very weak, a most sensitive relay is required to operate the call bell or call lamp at both ends.

A somewhat similar application is its use for high-frequency telephony and telegraphy on high-pressure conductors between power stations. In case of breakdown, this permits communication, for example, between the generating station and its sub-stations to be established more rapidly than with a special telephone line. Messrs. Ruth have installed such outfits with their new relay in a number of German and Swiss power plants.

Other possibilities for the new relay are in connection with ordinary radiotelegraphy and telephony, that is, for calling up ships in the same way as in the case of wired telephony, thus avoiding the need for a telegraphist to be continuously in charge of the ship's station. Ships in danger could also be warned automatically.

A high-speed telegraph apparatus recording and signalling Morse signals at enormous speed has been devised with a working current of 1/100,000 amp. The resistance of the line is of so little importance that very small wires can be employed. A rate of 2,000 letters per minute is said to be obtained with absolutely distinct type, no matter whether telegrams are sent by wireless or ordinary telegraph lines.

Loud-speaking telephones have likewise been constructed, the Johnsen-Rahbek system actuating a membrane in accordance with the fluctuations of the current supplied which amongst other things can be used for the broadcast wireless transmission of speech and music.

Porcelain Insulators for Overhead Lines.—The British Engineering Standards Association has recently issued Specification No. 137, 1922, in which are set out the requirements, with details of tests, for support and tension insulators in overhead power lines at pressures of from 3,000 to 150,000 V. This specification, which is the first of a series dealing with overhead line material, can be obtained from the B.E.S.A. offices, 28, Victoria Street, S.W.1, at the price of 1s. net, or 1s. 2d. post free.

Colour Light Signals.—The Committee appointed by the Minister of Transport, under the chairmanship of Major C. H. W. Edmonds, O.B.E., M.I.E.E., to investigate and report upon the possibilities of colour light signalling on railways, has presented its report. The Committee inspected examples of this type of signalling upon the Liverpool Overhead Railway and the London & South-Western Railway. In both cases it was found that signals were visible from a position 1,000 yards away in brilliant sunshine, whether the sun was behind or in front of the signals. The two principle types of light signal in present use are (*a*) colour lights in which indications are given by the use of red, green and yellow lenses; and (*b*) position lights, in which a series of white lights simulate by their arrangement the various positions taken up by the arm of a semaphore signal. The Committee is of the opinion that the former method is preferable, both as regards practicability and first cost and maintenance. The comparing of costs has proved difficult. In the case of a comparison between an isolated manually-worked semaphore signal and a colour-light signal at the same distance from the signal cabin, there is probably little difference in the costs of installation and maintenance. The determining factor, however, is not the length of track equipped but the density of signals per mile; the greater this is the greater is the probable saving in favour of light signals. This applies more particularly to such congested districts as large station yards and terminals. Further economy is obtained in that lighter and cheaper structures could be employed in the case of gantries and overhead bridges. It is probable that the penetrative power of the electric lamp would obviate the use of fog repeater signals. The Committee considers that three sizes of light signals should be sufficient to cover all requirements. It is also of opinion that electricity is the only practical and economical method of dealing with the matter, and a.c. is recommended owing to its being possible to transmit power to the lamps at a high voltage and to reduce the pressure by simple transformers. Various recommendations are made as to the type of lamp which it will be found advisable to employ.

INSTITUTION NOTES.

Illuminating Engineering Society.—The report of the Council of the Society for the past session, presented at the annual meeting on May 25th, referred to the variety of subjects dealt with in recent discussions, and the fact that on several occasions joint meetings with other bodies were arranged. Other instances of co-operation are furnished by the Society's various joint committees. International co-operation in illuminating engineering was illustrated at the important first technical session of the International Illumination Commission held in Paris last year, and by the fact that industrial lighting is now receiving attention from the International Labour Bureau of the League of Nations at Geneva. Attention was also drawn to various official reports issued recently by committees associated with Government Departments.

Following the annual report, an address was delivered by the president, Sir John Herbert Parsons, C.B.E., F.R.S., an eminent ophthalmic surgeon who has devoted much attention to lighting problems. Sir John referred to the work of the Home Office Departmental Committee on Lighting in Factories and Workshops, for which many thousands of photometric measurements had been made. At the moment the Committee was not prepared to recommend legal minima for industrial processes, but it proposed to issue schedules of values for "fine" and "very fine" work, indicating "recommended practice" in this respect. Physicists in general were apt to forget that the basis of physical measurements was biological, for the so-called "outer world" only existed for them by virtue of the sensations it aroused in their bodies. The eye was the most highly differentiated sensory organ, and its complexities were especially revealed in photometric work. The "personal equation" must always be considered. In all observations there was liability to error, which was eliminated so far as possible by taking the mean of a number of observations and applying the theory of probability. The president referred to the kinetic theory of gases and the modern view of atomic weights, as illustrating the application of the law of averages at the present time. In conclusion, he remarked that there existed a wide almost uncharted area in the study of problems, in which the effect of peculiarities of the eye had to be considered. People talked glibly about eyestrain, but there were many sources of discomfort that still needed elucidation. Amongst these was the phenomenon of "glare" in lighting.

Institute of Metals.—The annual autumn meeting of the Institute, of which Mr. Leonard Sumner, O.B.E., M.Sc., is president, is to be held at Swansea from September 20th to 22nd. It will be the first meeting to be held by the Institute in South Wales, but Swansea is, of course, a metallurgical centre of great importance, there being works in the neighbourhood producing copper, zinc, nickel, and other metals, as well as tin plate.

Members will assemble in Swansea on September 19th. On September 20th there will be an official welcome by the Mayor, and the remainder of the morning will be devoted to the reading and discussion of papers. After an official luncheon a visit will be made to the University College at Singleton, where tea will be provided. In the evening there will be a reception by the Mayor. On September 21st the morning will be devoted to the reading and discussion of papers, and after luncheon there will be visits to works, the evening being devoted to entertainment. It may be necessary for a morning session to be held on the concluding day of the meeting, September 22nd, but arrangements will be made for motor excursions in the district, in which there is beautiful coast and inland scenery.

Association of Officers and Staff Members of Electricity Companies of Great Britain.—The annual general meeting of the Association will take place on June 20th at the Caxton Hall, Westminster, at 8 p.m. The report of the executive committee for 1921 states that Sir Alexander B. W. Kennedy, F.R.S., has again consented to accept the presidency of the Association. The Committee reports the resignation by Mr. F. Wood of his seat on the Committee, and of the hon. treasurership of the Association. Mr. A. C. Tappenden has undertaken the duties of hon. treasurer, and the vacancy on the Committee will be filled at the annual general meeting. In December, 1921, the first claim under Section 16 of the Electricity (Supply) Act, 1919, was heard by Sir W. Mackenzie, the referee appointed by the Minister of Labour. The claim was made by the officers and servants of the Electricity Department of the Corporation of Morley, Yorkshire, and arose from the fact that that Corporation arranged to take a bulk supply from Leeds, and to shut down its own generating works. Some compensation was awarded, and to that extent the result was satisfactory as proving the value of the efforts of the Association in securing the insertion of the Section in the Act. A claim for compensation for loss of status by the officers of the undertaking owing to its ceasing to generate electricity, and only continuing to distribute a supply received in bulk from an outside source, was, however, held by the referee not to have been substantiated. It is hoped that in the Bill now before Parliament provision will be made for the appointment of the referees by the Commissioners instead of by the Minister of Labour. A new section has been inserted in the Bill now before Parliament favourably amending the wording of Section 16. The statement of accounts shows a credit balance of £517. The amended constitution of the Association, as approved at the general meeting on April 4th, 1921, has been circulated to members.

Institution of Municipal and County Engineers.—The annual general meeting and conference of the Institution will be held at Cardiff on June 21st—24th. Amongst the papers to be read is one on "Electric Vehicles for Municipal Work," by Mr. R. B. Mitchell, city electrical engineer, Glasgow, and demonstrations of plant, including electrical vehicles, will be given.

Diesel Engine Users' Association.—At the June meeting of the Association Mr. H. F. P. Purday read a paper on "Marine Diesel Engines." The author took the view that the Diesel engine must be seriously considered in the near future for propelling large vessels requiring something like 16,000 s.h.p. per shaft. In the discussion that followed the view was expressed that further development of the marine Diesel engine was likely to follow along the lines of the double-acting two-stroke engine. Interesting information was given concerning the cylinder construction of the "Stil" engine, and reference was made to the greater use of the larger sizes of engine for land use on the Continent and in other countries abroad, possibly due, to some extent, to the fact that this country was a coal producing country. Stress was laid on the importance of reducing, as far as possible, the cost of manufacture, and the point was made that the present high cost of the larger units for land use was due to the comparatively small demand up to date.

Association of Consulting Engineers.—The annual general meeting was held on May 29th, under the chairmanship of Mr. W. Vaux Graham, M.Inst.C.E. The report of the Committee for the year ended April 30th last was presented and adopted. This report recorded the election of nine new members, one resignation, and one death, bringing the total membership up to 84. Satisfaction is expressed at the fact that three of the new members practise in the Dominions—indicating a widening of the Association's scope. In response to many requests, a form of agreement between consulting engineers and their clients has been drawn up; this embodies the Association's rules governing the relations between the two parties. It is proposed to again hold the annual dinner later in the year. Owing to the Association's inability to

accept the I.E.E.'s Model General Conditions of Contract in the form which they appeared likely ultimately to take, it was decided to withdraw from representation upon the committee appointed to revise these conditions. After discussion with the B.E.A.M.A., it was decided that the Association should itself draft a set of conditions for use where members of the Association and members of the B.E.A.M.A. were jointly concerned. A draft was accordingly prepared and a sub-committee to deal with the matter formed. One principle underlying these conditions was that responsibility for the design of the works should rest with the engineer, but that in the event of the contractors being dissatisfied with any of his decisions, the matter should be referred to an independent arbitrator. All the clauses but two were agreed upon. These two, relating to the limitation of the contractor's liability for damage, were found to debar the acceptance by the B.E.A.M.A. of the conditions, but the Association decided to recommend the remainder to its members. The Association has participated in a committee formed by the I.E.E. to deal with the subject of the registration of electrical contractors.

The accounts showed an excess of income over expenditure of £96.

As a result of a ballot for officers, the following London members were elected to the committee: Messrs. A. T. Cooper, J. Mitchell Moncrieff, C.B.E., A. H. Preece, and H. J. Rofe. The country members elected were Messrs. H. P. Hill and J. A. Warren.

Institution of Civil Engineers.—The annual conversazione has been fixed to take place on Tuesday, June 27th, at the Institution at 8.30 p.m.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Prof. T. MATHER, F.R.S., M.I.E.E.—The approaching retirement of Prof. Thomas Mather from the Chair of Electrical Engineering at the City and Guilds of London (Engineering) College, South Kensington, is a matter of personal interest literally to thousands of engineers throughout the British Empire; for, over a period of exactly 40 years, he has played an effective part in the training of British students of engineering—nay, more—he has been largely instrumental in determining the form that that training should take in this country, and doubtless his influence in this respect has been widely felt abroad. As assistant to the late Prof. W. E. Ayrton before the first technical college was brought into being, and when the three pioneers, Ayrton, Perry, and Armstrong, were developing a system of technical training, he shared in the pioneer work of those gifted organisers; and no one who knows him will doubt that his share was an important proportion of the total, or that he applied himself to the task with untiring enthusiasm and catholic efficiency.

A "Lancashire Lad," Prof. Mather was born in 1856, at Higher Walton, near Preston, and "served his time" as apprentice with Thomas Whittaker & Sons, millwrights and engineers, Higher Walton, and Joseph Clayton & Sons, engineers and boiler makers, Preston. He attended St. Paul's science classes, Preston, from 1875 to 1878, to excellent purpose, becoming First Whitworth Scholar in 1878, and First Royal Exhibitioner in 1881; thus he was enabled to devote some years to the study of chemistry, engineering, geology, mathematics, and physics at Owens College, Manchester, under Roscoe, Osborne Reynolds, Boyd Dawkins, Barker, and Balfour Stewart respectively—names that were household words to the science students of the last generation. He gained prizes in geology and physics, the Ashbury Engineering Scholarship, and the Engineering Certificate with Honours in Mathematics and Engineering. After a further twelvemonth's study of chemistry and mechanics under Profs. E. Frankland and T. Goodeve, at the Normal College of Science, South Kensington, in July, 1882, he was appointed assistant to Prof. Ayrton, who was then conducting classes in the basement rooms of Cowper Street Middle-Class Schools, pending the building of the Finsbury Technical College of the City and Guilds of London. In January, 1885, he became assistant to Prof. Ayrton at the Central Institution, later styled the Central Technical College, and now the City and Guilds (Engineering) College of the Imperial College of Science and Technology. After the death of Prof. Ayrton, in 1908, Mr. Mather was appointed his successor, and thus for 37 years he has been associated with the premier technical college of this country. He was elected a Fellow of the Physical Society in 1887, and attained to the coveted distinction of Fellow of the Royal Society in 1902; he joined the Institution of Electrical Engineers in 1890, becoming a Member in 1908, and has served on the Council and on various committees. Throughout his teaching career Prof. Mather has been deeply interested in electrical instruments; his first paper, read before the Physical Society in 1885, dealt with "Calibrating a Galvanometer with Constant Current," and his paper on "The Shape of Movable Coils in Electric Measuring Instruments," in 1890, formed the basis of the well-known Ayrton-Mather narrow-coil galvanometer, leading the way also to the moving-coil oscillograph, which was developed by the late W. Du Bois Duddell in the laboratories of the Central Technical College. Besides galvanometers, Prof. Mather has devoted special attention to field testers, shunts for galvanometers (the "Universal" shunt is associated with his name), electrostatic measuring instruments, non-inductive resistances, anti-capacity resistances, precision wattmeters (the Duddell-Mather type), and absolute measurements of resistance, current, and potential difference to a high degree of accuracy; in association with Mr. F. E. Smith, O.B.E., F.R.S., then of the N.P.L., he determined the ampere and

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Prof. T. MATHER, F.R.S., M.I.E.E.,
who shortly retires from the position of Professor of Electrical Engineering, City and Guilds of London (Engineering) College, South Kensington.

the e.m.f. of the cadmium cell, with the greatest precision attained at that date. He has also specialised in the design of chokers (reactances of very low power factor). On all these subjects Prof. Mather has indelibly impressed the mark of his originality and inventive genius; but greater by far than this achievement is the success that he has attained by virtue of his enthusiasm, his inspiration, his unfailing common sense, and his untiring industry, united with a genial and patient disposition and modesty carried to a fault, in building for himself in the hearts of his pupils, colleagues, and other friends a monument of admiration and affection more enduring than brass. He leaves the City and Guilds College at the end of a session in which the numbers of third and fourth-year electrical engineering students are the largest in the history of the college.

Prof. C. L. FORTESCUE, O.B.E., M.I.E.E., M.A., who has been appointed to succeed Prof. Mather as Professor of Electrical Engineering at the City and Guilds of London (Engineering) College, Exhibition Road, was educated at Oundle School and Christ's College, Cambridge.

He was natural science scholar (of the college) in 1900, and attained a first-class in the Mechanical Sciences Tripos, 1903. He served a post-graduate apprenticeship at Messrs. Siemens Bros.' Dynamo Works from 1903 to 1905. In the latter year he entered the testing department, at the same works, and remained until the year 1906, when he was appointed lecturer in electrotechnics and applied mechanics, at H.M. Gunnery and Torpedo Schools, at Portsmouth. This appointment he held until the year 1911, when he became Professor of Physics at the R.N. College, Greenwich, which he will leave shortly for the purpose of entering upon his new duties as Prof. Mather's successor. During the whole period of the war he was lent to H.M.S. *Vernon* and H.M. Signal School for wireless telegraph duties. Prof. Fortescue is a Member of the Institution of Electrical Engineers, and

is on the Wireless Section Committee. He read a paper on "The Three-Electrode Thermionic Valve as A.C. Generator," before the British Association, in September, 1919, and one on "The Design of Multiple Stage Amplifiers," before the Wireless Section of the I.E.E. a few months later. He is also a Fellow of the Institute of Physics, and of the

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Prof. C. L. FORTESCUE, O.B.E., M.I.E.E., M.A., who takes office as Professor of Electrical Engineering at the City and Guilds of London (Engineering) College, Kensington, in succession to Prof. T. Mather.

Physical Society, and is a member of the council of both of these bodies.

Mr. DUNCAN P. MORRISON, former manager of the Tynemouth and District Electric Traction Co., who has recently retired, has been presented with a silver tea service and salver from the employés and staff. Mr. J. A. Somerville, the newly appointed manager, formerly of Swansea, was in the chair.

The Albert Medal of the Royal Society of Arts for 1922 has been awarded by the Council to Sir DUGALD CLERK, K.B.E., F.R.S., D.Sc., LL.D., in recognition of his important contributions, both theoretical and practical, to the development of the internal-combustion engine.

In order to deal more conveniently with his business, Mr. W. M. SELVEY, Wh.Sc., M.I.E.E., of Sheffield, is opening a London office at 23, Old Queen Street, Westminster, S.W., and he will reside in London.

Mr. J. F. ASHTON, electricity manager to the Parkhill Colliery, Stanley, near Wakefield, was married on June 8th at Keighley, to Miss Amy Croft, of Keighley.

Mr. D. S. DEARDEN, assistant electrical engineer under the Hebden Bridge District Council, Yorkshire, was married last week at Heptonstall Slack Baptist Church to Miss Ethel Pickles, youngest daughter of Councillor S. Pickles, of Hebden Bridge.

The marriage took place on June 1st, at St. Paul's Church, Halifax, of Mr. Eric N. JOHNSON, A.M.I.E.E., and Miss Lena Barnes, of Warley Wood, Luddenden Foot.

The engagement is announced between NORMAN FELIX HERBERT FREUDENTHAL, late Grenadier Guards and Iris Hilda, elder daughter of Mr. and Mrs. M. J. Railing, of "Whiteknights," Reading, and 71a, Duke Street, W.

Owing to ill-health Mr. W. R. RENDELL has decided to resign the general managership of the Metropolitan Electric Supply Co., Ltd., in the autumn. He has held the position with great success during the difficult period since the commencement of 1916, and it is with regret that his resignation has been accepted by the board of the company.

Obituary.—MR. FRANCIS R. REEVES.—We deeply regret to record the death, which occurred on Saturday last at his residence, Lynwood Cottage, Herts., of Mr. Francis R. Reeves, who will be well remembered by many of our readers as a former secretary and general manager of Crompton & Co., Ltd. Latterly Mr. Reeves had been connected with various electricity supply companies, including the Sevenoaks Co., of which he was managing director, the Electric Supply Corporation, Ltd., the Chagford and Devon Co., and the Calcutta Electric Supply Corporation. He was 79 years of age.

NEW COMPANIES REGISTERED.

Radio Instruments, Ltd. (182,272).—Private company. Registered June 2nd. Capital, £10,000 in 7,500 8 per cent. cumulative preference shares of £1 each and 50,000 ordinary shares of 1s. each. To carry on the business of electrical, mechanical and general engineers and contractors, manufacturers and sellers of transformers, radiators, dynamos, motors and radio instruments of all kinds, and electric lighting, power and transmission plant, wireless apparatus, &c. The permanent directors are: J. Joseph, M.I.E.E., 50, Handen Road, Lee, S.E.12; W. A. Appleton, M.B.E., M.I.R.E., St. Denys, Oakington Avenue, Wembley Park, Middlesex, with 100 guineas per annum, in addition to any other remuneration or payment they may receive from the company. Registered office: 18a, Hyde Street, Oxford Street, W.

New Electric Sign Co., Ltd. (182,266).—Private company. Registered June 2nd. Capital, £2,500 in £1 shares (1,000 preference). To take over the business of an electric sign manufacturer and agent carried on by A. E. Davis at the "New Electric Sign Co.," at 53, Haymarket, S.W. The first directors are: A. E. Davis, 8, Seaforth Road, Westcliff-on-Sea, Essex; J. H. Slingsby, "Middlemarsh," Hinckley Road, Nuneaton. Remuneration as fixed by the company. Secretary: S. H. Grant. Registered office: 53, Haymarket, Westminster, S.W.

John M. Boyd, Ltd. (12,249).—Private company. Registered in Edinburgh June 6th. Capital, £5,000 in £1 shares. To carry on the business of general, electrical, motor car and cycle engineers, &c. The first directors are: J. M. Boyd, Ballochmill Road, Ruthergien, coachbuilder and engineer; J. B. Andrews, Clydesdale Bank House, Helensburgh. Qualification: 280 shares. Secretary: David R. Galloway. Registered office: Ballochmill Road, Eastfield, Rutherglen.

Johnson Radio Co., Ltd. (182,326).—Private company. Registered June 7th. Capital, £100 in £1 shares. To carry on the business of engineers, manufacturers of and dealers in ordinary and wireless telegraphy and telephonic apparatus, and accessories and electrical tools and apparatus generally, &c. The first directors are: H. M. Smith, 44, Effendine Mansions, Maida Vale, W.9; S. Tootill, 2, Sneath Avenue, Golders Green, N.W. (both directors of Johnson Talking Machine Co., Ltd.). Qualification: 1 share. Secretary (*pro tem*): H. G. Goodsman. Registered office: 244, Tottenham Court Road, W.C.

W. Blackburn (Kew), Ltd. (182,280).—Private company. Registered June 2nd. Capital, £1,000 in £1 shares (800, 8 per cent. cumulative preference). To carry on the business of electrical, mechanical, motor, and general engineers and contractors, manufacturers of and dealers in transformers, radiators, dynamos, motors, and all kinds of electric lighting, power and transmission plant, manufacturers of and dealers in motor cars, motor cycles, &c. The subscribers (each with one share) are: W. Blackburn, The Chimes, 47, Grove Park Road, Chiswick, W.4, engineer; E. W. Birtles, 24, Riverview Road, Chiswick, W.4, advertising manager. The first directors are W. Blackburn (permanent governing director, subject to holding £50 shares), and one other person, or persons, to be appointed by the subscribers. Solicitors: T. E. Godbold, 529, High Road, Chiswick, W.4.

World's Electric Co., Ltd. (182,283).—Private company. Registered June 2nd. Capital, £1,000 in 1s. shares. To carry on the business of manufacturers of and dealers in electrical accessories, appliances, lamps, apparatus, plant and machinery, contractors, &c. The first directors are: A. Richmond, 1, Gresham Buildings, E.C.2, merchant; J. W. Conrad, Cromwell House, High Holborn, W.C.; W. F. Pearce, 33, Camomile Street, E.C.3, flag maker. Qualification: 100 shares. Registered office: 1, Gresham Buildings, E.C.2.

East Coast Motor Boat Services, Ltd. (182,346).—Private company. Registered June 8th. Capital, £2,000 in £1 shares. To acquire motor and electrical boats, launches, and other similar craft for use round the coasts and on the rivers of Great Britain, &c., and to adopt an agreement with H. E. Kingsman and Ada J. Kingsman. The first directors are: E. Kingsman, Grand Hotel, Lowestoft; Ada J. Kingsman, Grand Hotel, Lowestoft; H. E. Kingsman, Grand Hotel, Lowestoft (all directors of East Coast Piers, Ltd.). Qualification of first directors, one share; of subsequent directors, £250. Remuneration: £100 each per annum. Registered office: Mansion House Chambers, 20, Bucklersbury, E.C.4.

Arco Institute Ltd. (182,285).—Private company. Registered June 6th. Capital, £100 in £1 shares. To adopt an agreement with A. Rosenberg and to carry on the business of electro-therapy, electro-medical treatment, and all kinds of electrical and mechanical baths, &c. The first directors are: H. J. Munro, Charlwood, Huyton, Liverpool; A. Rosenberg, 2, Vere Street, Oxford Street, W.1. Qualification, £25. Remuneration: £50 each per annum (chairman, £100). Registered office: 3, London Wall Buildings, E.C.2.

Chimes, Ltd. (182,289).—Private company. Registered June 6th. Capital, £500 in £1 shares (400 "A" ordinary and 100 "B" ordinary). To adopt an agreement with W. A. Greening, W. A. Rowe, and W. E. Schall, and to develop and turn to account patent No. 171,835, for the manufacture of apparatus for electrically ringing church bells referred to therein. The permanent directors are: W. E. Schall, Woodcote Cottage, Howard Road, Coulsdon; W. A. Greening, 6, Somerford Grove, N.17. Qualification: 100 "A" ordinary shares. Remuneration (except managing director), £100 per annum divided between them. Secretary: E. Dunkel. Registered office: 71-5, New Cavendish Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Swift Electrical, Ltd.—Louisa Butler, of 94, Woodland Gardens, N.10, ceased to act as receiver or manager on May 31st, 1922.

H. E. Steel, Ltd.—Mortgage dated May 15th, 1922, to secure £1,000, charged on certain freehold hereditaments in Stroud, Glos. Holder: Mrs. E. Lendon, 1, London Road, Stroud, Glos.

T. P. Pollitt & Co., Ltd.—A. A. Reeves, of Court Chambers, Town Hall Square, Grimsby, ceased to act as receiver or manager on May 31st, 1922.

British Driver-Harris Co., Ltd.—Mortgage dated May 29th, 1922, to secure £14,500, charged on land with Gathorn Mills thereon, in Albion Street and Little Peter Street, Manchester. Holder: J. F. Linney, 12, Tib Lane, Manchester.

Northwood Electric Light & Power Co., Ltd. (66,312).—Return dated April 13th, 1922. Capital, £60,000 in £1 shares (15,000 preference and 45,000 ordinary). 6,880 preference and 12,507 ordinary shares taken up. £1 per share called up on 8,282 ordinary and 6,880 preference. £15,162 paid. £4,225 considered as paid on 4,225 ordinary. Mortgages and charges, £4,625.

Midland Electric Wire Co., Ltd. (104,571).—Return dated April 14th, 1922. Capital, £5,000 in £1 shares. All shares taken up. £5,000 paid. Mortgages and charges, nil.

W. T. Glover & Co., Ltd. (56,124).—Return dated April 4th, 1922. Capital, £214,850 in £1 shares (100,000 preference and 114,850 ordinary). All shares taken up. £1 per share called up on 67,000 preference and 50,000 ordinary shares. £117,000 paid. £97,850 considered as paid on 33,000 preference and 64,850 ordinary. Mortgages and charges, nil.

Charing Cross, West End & City Electricity Supply Co., Ltd. (29,122).—Return dated March 23rd, 1922. Capital, £2,100,000 in 130,000 preference, £130,000 ordinary, 80,000 City undertaking preference, and 80,000 City undertaking ordinary shares of £5 each. 80,000 preference, 80,000 ordinary, 80,000 City undertaking preference, and 70,000 City undertaking ordinary shares taken up. £1,300,000 paid on the preference, ordinary, and City undertaking preference. £350,000 considered as paid on the City undertaking ordinary. Mortgages and charges, £1,374,178.

CITY NOTES.

Ruston and Hornsby, Ltd.

The advance summary of the report for the year ended March, 1922, shows a gross profit of £101,637, compared with £108,682 for the previous year. After paying debenture interest, allowing for depreciation and the preference dividend to July, 1921, £58,230 remains, but the directors state that owing to the continued trade depression and the serious fall in stock values it is essential that the whole of the balance should be retained in the business, and in addition they have thought it wise to transfer £100,000 from the general reserve to meet a possible further fall in the values of stock-in-trade. Under the circumstances they do not recommend the payment of the outstanding dividend on the preference shares, or a dividend on the ordinary shares for the past year. According to the financial Press the accounts of Ransomes, Sims & Jefferies, Ltd. (associated with Ruston and Hornsby) for the same year show a profit of £3,997, against £15,457 for the previous year. The dividend on the preference shares to June 30th, 1921, absorbed £2,750, leaving with £40,811 brought forward, £42,058, but having regard to the continued adverse trade conditions, the fall in selling values and the necessity for conserving the resources the directors are unable to recommend any dividend on the ordinary shares for the year or on the preference shares for the half-year to December 31st, 1921. The stocks of manufactured goods and raw materials have been valued at under cost.

Delhi Electric Tramways and Lighting Co., Ltd.

At the annual meeting, on June 8th, the Chairman said that the results of the past year were achieved without any assistance from exchange profits—indeed, there was a slight loss under this head. An increase in the profits of the supply undertaking had balanced the loss on the tramways, making the net profit almost the same as that of the previous year. The conditions in India had been adverse. Trade was bad and troubles at the collieries had curtailed coal supplies, and had had a bad effect upon the quality of the fuel. In addition to this there had been a strike of the company's employés. The total number of units sold increased from 2,342,000 to 2,717,000, but the supply to the tramways showed a decrease. To meet the demand it was necessary to increase the plant as the Government supply was unreliable; two small Diesel sets had been ordered, and should be in commission shortly. Further Diesel sets would be erected during the next two or three years.

The speaker was optimistic of the future in India, considering that the worst period of unrest had passed.

Pernambuco Tramways and Power Co., Ltd.

The annual general meeting was held in London, on June 7th. Mr. Follett Holt (chairman), who presided, said that last July he expressed the view that the company was upon the high road to an improved state of affairs, provided that the exchange position recovered. During the past year, however, there had been a heavy fall in exchange. The operation of the sliding scale of charges did not counterbalance the loss and, consequently, there was a decrease in revenue of £22,301, as compared with last year's earnings. Nevertheless, by using the greater part of the balance brought forward it was possible to meet all the fixed charges. The figures showing the passenger traffic and electricity sold proved that there was real vitality in the company which would tell when conditions became normal. The gas department was agin o na profit-earning basis. It must be realised that progress in the electrical department would adversely affect the gas undertaking: the future of the latter lay not in lighting but in heating and cooking. Referring to the work during the first five months of the present year, the chairman said that, as compared with the equivalent period of last year, there had been an increase of 35 per cent. in the net earnings, and it was believed that this improvement would continue. When the electrification of the remaining 10 km. of steam tramways had been completed, and the Tigipio extension finished, the new system of fares would come into operation and further improve matters. The materials necessary for the completion and equipment of these lines had been shipped to Pernambuco, and within the next few weeks the new and rebuilt sections would be opened to traffic. During the year under review it had been possible to carry out a great deal of renewal and repair work, and the condition of the property had been much improved.

Barcelona Traction, Light and Power Co.

Revenue for 1921, $2,065,537, less administration and general expenses, &c., $160,936, interest on seven per cent. prior lien "A" bonds, six per cent. prior lien "B" bonds (payable in cash), six per cent. six-year bonds and service of eight per cent. secured debentures, $1,307,846, leaving available for interest on first mortgage bonds $596,755. Interest paid on first mortgage bonds (being at rate of 2 per cent. per annum) totalled $753,627. No credit has been taken for revenue receivable from Tramways Co. in respect of 1921, as at the time of closing the books the Tramways Co. had not declared the dividend for 1921 or determined amount payable to this company. It has now been ascertained that the amount receivable will be approximately $250,000, and this sum will be brought into the 1922 accounts. Usual provision was made for amortisation of underlying bonds, and in addition reserves for depreciation were made by chief operating companies as follows: Light and Power Companies, $771,868; Railway Co., $119,106. In December, 1921, at meetings of holders of first mortgage bonds and income bonds resolutions were passed by which nominal interest payable on first mortgage bonds was raised to 6 per cent. and minimum interest payable in any event was fixed at 2 per cent., and interest for 1921 was paid at this rate as the revenue did not justify a higher percentage.—*Financial Times.*

Globe Telegraph and Trust Co., Ltd.

The net revenue for the year ended May, 1922, after deduction of expenses, amounts to £330,146, plus £2,181 brought forward, making £332,327. From this £233,605 has been distributed in interim dividends, leaving an available balance of £98,722. The directors now recommend the payment of the following final dividends, viz.: 3s. per share, less income tax, on the preference shares, making, with previous distributions, a total dividend for the year on those shares at the rate of 6 per cent. per annum, less income tax; and 5s. per share net on the ordinary shares, making, with previous distributions, a total dividend on these shares at the rate of 10 per cent. net for the year. These will absorb £77,868, leaving a balance of £20,854 to be carried forward. During the year 53 certificates of the Submarine Cables Trust, belonging to this company, were drawn and paid off at £120 per certificate. The proceeds have been re-invested in Eastern Telegraph Co.'s ordinary stock and Eastern Extension, and Western Telegraph Companies' shares. New Articles of Association will be submitted for approval at the meeting on June 20th.

United River Plate Telephone Co., Ltd.

The gross earnings for the year ended December 31st, 1921, amounted to £1,161,848, whilst the gross maintenance and other charges in Argentina and London were £981,411, leaving a profit of £180,438. Interest on debenture stock and dividend on the preference shares to December 31st, 1921, and the interim dividend on the ordinary shares absorbed £72,100, leaving £108,338 plus £38,367 brought forward, making the available balance £146,705. The directors recommend a final dividend of 5 per cent. on 324,000 ordinary shares, making 8 per cent. for the year, free of income tax at 6s. in the £, and a dividend of 5 per cent. on 108,000 ordinary shares, free of income tax at 6s. in the £, in accordance with the terms of the allotment letter of June 16th, 1921. There is to be carried forward £38,705. The business has made progress during the past year, but though a record number of subscribers have been connected, many thousands of applicants are still awaiting service. The automatic plant now in course of erection will relieve the position somewhat, but it is hoped the Government will shortly realise that the large amount of capital needed to meet the additional telephonic requirements of the country cannot be raised until the increase in the tariffs petitioned for in 1919 is granted. The death of Dr. Luis M. Drago, the esteemed chairman of the local committee in Buenos Aires, occurred in June, 1921.

Aluminium Corporation, Ltd.

Mr. Kenneth M. Clark (chairman), presiding at the annual general meeting, on June 7th, said that two years' accounts were presented, the last meeting having been adjourned. The issued capital showed the small increase of £4,014, due to the issue of preference shares in the usual way. The first debenture issue showed a reduction of £6,400, and second debentures an increase of £150,000. During the past two years £321,421 had been expended on constructional work, including £216,000 spent on the Llugwy & Cowlyd dams and water rights; £46,000

on the acquisition of freehold land, buildings, and water rights; £33,000 on new buildings and structures at Dolgarrog; and over £24,000 on new plant and machinery. The results of the two years were not unsatisfactory in spite of great difficulties. The large stocks of aluminium which were in existence in all countries at the close of the war required a considerable time for clearing, and with regard to some items the market was still affected. The coal strike and the engineering lock-out also created difficulties. He thought, however, that the bottom of depression had been reached, and with the growing goodwill of labour, conditions would gradually improve. The great obstacle to the realisation of this hope was the burdensome taxation to which industry was subjected.

Owing to the time required to make the necessary reservoirs and negotiate the various rights in connection with the dams at Cowlyd and Llugwy, the accounts did not show any returns from these undertakings. Now, however, the dams had been completed and the work of constructing the canal between the two sites should be finished in about three months. Then the company would have a much-increased supply of electricity, both for manufacturing purposes and for the North Wales Power & Traction Co.

It was proposed to hold an extra-ordinary general meeting, following the ordinary meeting, to sanction the increasing of the directors' borrowing powers by £500,000 (secured by debentures). This extra capital would enable them to increase the capacity of the rolling mill, to install a second and larger pipe line with penstock reservoir, and to erect a new power house. This would permit the use of a large part of the water-power which still remained undeveloped.

In reply to a question, Mr. Clark said that the North Wales Power & Traction Co. was extending its lines in many directions along the coast and there was no doubt that the company would, in time, be able to absorb the whole of the Corporation's surplus power. The company had not yet earned sufficient money to pay off any of its funding certificates.

The report and accounts were adopted, and at the subsequent extra-ordinary meeting the powers asked for were conferred upon the directors.

Prospectus.—*The Electrical Apparatus Co., Ltd.*—The subscription list is to close "on or before" to-morrow, Saturday, in an issue of 50,000 eight per cent. cumulative preference shares of £1 each at par. The objects of the issue are described as follows:—"Additional capital should result in a considerable increase in the profits, and particularly for the following reasons:—1. The company at present purchases large quantities of certain materials from outside sources. Ample space is available at St. Albans Works for the manufacture of these, and money spent on the necessary plant should earn a good return. 2. From modest beginnings the company has gradually risen to a point where it can claim to be one of the leading firms in its own line of business. Efficient and comprehensive technical, manufacturing, and sales organisations are already available, and additional capital will enable the company to take up certain complementary lines. These should prove both profitable in themselves and of material assistance in increasing the sales of the existing manufactures."

Brazilian Traction, Light & Power Co.—The directors, at a meeting held in Toronto last week, decided that, although the exchange value of the milreis continues considerably lower than was generally anticipated, and it is difficult to forecast the future, there are clear indications of such improvement in general conditions as to justify the resumption of the payment of dividends on the ordinary shares, and the board accordingly declared a dividend of 1 per cent. on the ordinary share capital. This is the first ordinary dividend since that declared for the year 1917.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be officially quoted:—

Birmingham District Power and Traction.—146,846 6 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 1 to 146,846.

North Metropolitan Electric Power Supply.—£250,000 8 per cent. cumulative second preference stock.

New Diesel Engine Co.—The *Financial Times* reports that the North British Diesel Engine Works (1922), Ltd., was registered in Edinburgh as a private company on May 30th, with a capital of £500,000 in £1 shares to acquire the business of engineers and engine builders carried on by the North British Diesel Engine Works, Ltd., at Jordanvale, Glasgow. The registered office is at the North British Diesel Engine Works, Whiteinch, Glasgow.

Chloride Electrical Storage Co., Ltd.—A further dividend of 5 per cent. on the ordinary shares, making 10 per cent. free of tax, is recommended for the year ended March, 1922. £20,000 is put to employés' benefit fund, £20,000 to reserve, and £31,613 is to be carried forward.

Manila Electric Corporation.—Dividend of 2 per cent. for the quarter ending June 30th on common stock.

Yorkshire (Woollen District) Electric Tramways, Ltd.—The receipts for 1921 amounted to £124,331 (against £125,161). After deducting all charges, setting aside £15,000 for renewals fund, and adding £9,357 brought forward, there is an available balance of £18,238. £5,000 is transferred to reserve, and £13,238 is carried forward.

A Brazilian Electrification Loan.—Allotments for the Brazil Central Railway Electrification Loan in New York are on the basis of 20 per cent. of the amount applied for, states *The Times* New York correspondent.

Callender's Share & Investment Trust, Ltd.—An interim dividend of 4 per cent., *i.e.*, at the rate of 8 per cent. per annum, less income tax, is recommended.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange is waiting for a fall in the Bank Rate. This, at least, is the generally-accepted explanation of the somewhat sleepy state into which markets have subsided—a state very different from the lively bustle that characterised them during May. The attractions of Ascot are held to be another reason for the abstention of clients, and for their reluctance to take any hand in the business of stocks and shares. Maybe, the real reasons are made up of a variety of causes, bulking largely amongst which is the undoubted fact that there has been an overdose of new issues lately. Too many stags remain in the field. Until stocks have got into more permanent hands, prices will remain on the dull side. A fall in the Bank Rate might, however, serve to bring in a fresh set of buyers.

Notwithstanding the heaviness of British Government and other investment stocks, a steady demand for Metropolitan Railway 5 per cent. preference is worth noticing, as an illustration of people's readiness to take good stock which can be bought free of the onerous one per cent. stamp-duty on transfers. The latest Indian electric debentures, Calcutta seconds, Indian and Madras, are all obtainable in scrip-form, either partly and fully-paid. The premium on the first-named has dwindled to 1¼ (as against 3¾ about three weeks ago), and to 5s. on the two others. Whitehall debentures are quoted at 88½, and the preference shares at 18s. 6d.

The Great Northern Telegraph Co. points out in its report that the "traffic as a whole does not as yet show any tendency to increase, but rather the reverse." However, the dividend and bonus are 22 per cent., as against 24 per cent. The price, after going 5s. lower, recovered to 80. Eastern Telegraph ordinary shows another rise. The company celebrated its jubilee last week; the staff is expecting some tangible mark of such an auspicious event. Other members of the Eastern cable group are firm. Globes have risen to 19, on publication of a good report.

Wireless shares remain erratic in their movement. Marconis dipped to 50s. and recovered to 51s. 9d. Marconis moved between 30s. and 32s. In Canadian Marconis there is nothing doing, and the price is droopy at 11s. 3d. Automatic Telephones went back a trifle to 12s. 6d., to harden again to 13s. 6d. International Telephone preference are quoted at 16s. 3d. The passing of the dividend on the ordinary shares of both these companies has checked what mild degree of interest had been aroused by the hope of increased profits resulting from the Postmaster-General's advocacy of the automatic telephone system.

The Brazilian Traction Co. has provided a pleasant surprise to its stockholders by the declaration of a quarterly dividend of one per cent. Nothing has been paid since January, 1917. That the company would revert to its pre-war dividend of 4 per cent. had been expected for some time past, as these notes have recorded upon various occasions. The Rio rate of exchange has militated against Brazilian companies making headway, except in the local currency, so that the resumption of dividend by the Brazilian Traction is so much the more gratifying. The common shares have risen 1 to 54, and the 7 per cent. preferred are better at 93¾. In our usual price-lists the yield on the former is calculated upon a 4 per cent. annual dividend.

Not a change has occurred in the list of home electricity shares. Prices are steady throughout, and the market shows a good deal of strength. Newcastle-on-Tyne first debentures slipped back to 90½, and the 6 per cents. are easier at 102½. British Thomson-Houston new 7½ per cent. preferences are being dealt in actively on the basis of 19s. 9d. to 20s. 3d. Provincial exchanges got ahead of London in this case, dealings taking place in the country before they were started in London. The London Stock Exchange Committee demurred at first to granting permission to deal until a certain letter, clearing up technical matters, had arrived from New York, but subject to this, bargains were permitted on Tuesday in this week.

Anglo-Argentine Tramways 5 per cent debenture stock is two points down at 80. British Columbia deferred strengthened to 74½. The Mexican group is easier for choice, although no particular change has developed.

Callenders, after their recent rise, reacted to 2 1/16. Henleys at 2 3/16 are 1/16 down, the preference shares at 4¼ have gained the fraction. General Electrics keep firm at 21s. 6d. Considerable interest is taken in the estimates with regard to the dividend due to be declared at the end of this month or at the beginning of July. Some people state that they will not be surprised if the usual 10 per cent. free of tax undergoes a modest reduction this time. Siemens are keeping up at 27s., and the company's 4½ per cent. debenture stock has come into demand, on the basis of 89. Dollar securities have given way, American Telephone common stock going back to 136.

The Home Railway market has suffered something of a shake-out. A fairly large bull account became built up, and liquidation on behalf of holders brought about a general drop, in the course of which Metropolitans gave way 1½ to 45½, Districts ½ to 38. Underground ordinary shares are ⅛ lower at 2⅜, the 1s. shares fell to 6s. 6d., and the Contingency Certificates can be bought at 6d., or less. Lord Ashfield cut the first sod of the new Hendon extension of the Charing Cross, Euston & Hampstead Railway on Monday, and it is hoped to have the line in operation in about fifteen months' time, while, three months later, the company expects to get from Hendon to Edgware. The market is awaiting with keen interest an issue of debentures from the London Electric Railway Co., or some other member of the group, which will carry the guarantee of the Government.

The rubber market remains inert. Iron, coal, and steel shares stiffened a little on the conclusion of the engineers' lock-out, while armament shares, after trifling improvements, relapsed into a condition of inactivity.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price June 19, 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	6½	—	6 11 0
do. do. do. 4½ Pref.	4½	4½	3½	—	5 16 2
Chelsea	6	6	5¾	—	5 6 8
City of London	14	14	38/9	—	7 4 0
do. do. 6 per cent. Pref.	6	6	22/6	—	5 6 8
County of London	8	8	1½	—	6 8 0
do. do. 6 per cent. Pref.	6	6	1	—	6 0 0
Kensington Ordinary	9	10	7½	—	7 0 7
London Electric	2½	4	2⅛	—	5 17 8
do. do. 6 per cent. Pref.	6	6	4½	—	6 3 1
Metropolitan	7	7	5½	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3½	—	6 0 0
St. James' and Pall Mall	12	12	8½	—	7 3 4
South London	7	7	3½	—	8 0 0
South Metropolitan Pref.	7	7	1⅛	—	5 18 0
Westminster Ordinary	10	10	7½	—	6 15 7
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref	6	6	104½	+ ½	5 14 10
do. Def.	1½	34/6	23½	—	7 7 0
Chile Telephone	6	6	6⅛	—	4 15 1
Cuba Sub. Ord.	7	7	8½	—	8 4 8
Eastern Extension	10	10	18½	—	5 8 1
Eastern Tel. Ord.	10	10	187½	+1	5 6 8
Globe Tel. and T. Ord.	10	10	19	+ ½	5 5 3
do. do. Pref.	6	6	11¼	+ ⅛	5 7 10
Great Northern Tel.	24	22	30	—	7 6 8
Indo-European	10	10	40½	—	6 3 5
Marconi	25	15	2⅞	— 1/16	5 17 0
Oriental Telephone Ord.	12	12	2½	—	*4 16 0
United R. Plate Tel.	8	8	7½	+ 1/16	*5 8 6
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18⅝	—	*5 6 0
HOME RAILS.					
Central London Ord. Assented	4	4	68	—	5 17 8
Metropolitan	1½	2½	45½	—1½	4 19 0
do District	Nil	1	38	— ½	2 12 8
Underground Electric Ordinary	Nil	Nil	2⅜	— ⅛	Nil
do. do. "A"	Nil	Nil	6/6	—6d.	Nil
do. do. Income	2	4	82½	—1	*4 17 0
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	2⅝	—	7 11 8
do. do. 2nd Pref.	Nil	5½	3½	—	7 6 8
do. do. 5 per cent. Deb.	5	5	80	—2	6 5 0
Brazil Tractions	Nil	Nil	54	+1	7 8 2
British Columbia Elec. Rly. Pcc.	5	5	81½	—	6 2 8
do. do. Preferred	5	92/-	70½	—	*6 11 6
do. do. Deferred	3	124/-	74½	+1	*8 7 0
do. do. Deb.	4½	4½	79	—	5 7 7
Mexico Trams. 5 per cent. Bonds	Nil	Nil	7½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	37½	—	Nil
Mexican Light Common	Nil	Nil	19½	—	Nil
do. Pref.	Nil	Nil	52	—	Nil
do. 1st Bonds	Nil	5	73½	—1	6 15 7
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	8½	—	5 2 8
British Aluminium Ord.	10	10	4½	—	—
British Insulated Ord.	15	15	28	+	7 1 2
Callenders	15	15	2⅛	— ⅛	7 5 3
„ 6½ Pref.	6½	6½	1⅛	—	5 9 5
Crompton Ord.	10	10	20/-	—	10 0 0
Edison-Swan	10	—	5/-	—	—
do. do. 5 per cent. Deb.	5	5	65	—	7 13 10
Electric Construction	10	10	1½	+	7 16 0
English Electric	8	8	15/-	—	6 13 4
do. do. Pref.	6	6	18/3	—	6 11 6
Gen. Elec. Pref.	6½	6½	22/3	—	5 16 10
do. Ord.	10	10	21/3	—	9 8 2
Henley	15	15	2⅛	— 1/16	6 17 0
do. 4½ Pref.	4½	4½	4⅜	+ 1/16	5 2 10
India-Rubber	10	—	1⅜	—	—
Met.-Vickers Pref.	8	8	24	—	6 8 0
Siemens Ord.	10	10	27/-	—	*7 8 2
Telegraph Con.	20	20	28½	—	*4 11 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 14th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per lb.	8d.	...
a Ammoniac, Sal ... per ton	£63	...
a Ammonia, Muriate (large crystal) „	£58	...
a Bisulphide of Carbon ... „	...	...
a Borax ... „	£30	...
a Copper Sulphate ... „	£27 10s.	...
a Potash, Chlorate ... per lb.	5d. to 5½d.	...
a „ Perchlorate ... „	7½d.	...
a Shellac ... per cwt.	£18 15s.	5s. inc.
a Sulphur, Sublimed Flowers ... „	£12	...
a „ Lump ... „	£11	...
a Soda, Chlorate ... per lb.	3½d.	...
a „ Crystals ... per ton	£7	...
a Sodium Bichromate, casks ... per lb.	5½d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton	£120	...
b „ Wire ... per lb.	1/9 to 2/6	...
b „ Sheet ... „	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... per ton net	£145	£4 dec.
Grade II ... „ „	£105	£2 dec.
Grade III ... „ „	£61	£1 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	½d. inc.
c „ Tubes (solid drawn) ... „	11¾d. to 1/-	...
c „ Wire, basis ... ... „	9½d.	...
c Copper Tubes (solid drawn) ... „	1/1½	...
c „ Bars (best selected) ... per ton	£94	£2 inc.
c „ Sheet ... ... „	£94	£2 inc.
c „ Rod ... ... „	£94	£2 inc.
d „ (Electrolytic) Bars ... „	£70	10s. dec.
d „ „ Sheets ... „	£145 10s.	...
d „ „ Wire Rods „	£80	10s. dec.
d „ „ H.C. Wire per lb.	10⅞d.	⅛d. dec
f Ebonite Rod ... ... „	3/6	...
f „ Sheet ... ... „	3/-	...
n German Silver Wire ... ... „	2/6	...
h Gutta-percha, fine ... ... „	12/6	...
h India-rubber, Para fine ... ... „	10½d.	...
l Iron Pig (Cleveland Warrants) ... per ton	90/-	...
l „ Wire, galv. No. 8, P.O. qual. „	£25	£2 dec.
g Lead, English Pig ... ... „	£26	15s. dec.
g Mercury ... ... per bot.	£11 15s. to £12 10s.	...
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e „ „ medium ... „	4/- to 8/-	...
e „ „ large ... „	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings „	1/1	...
p „ drawn bars and rods „	1/3	...
p „ rolled strip & sheet „	1/2½	...
p „ Wire ... ... „	1/3½	...
o Platinum ... ... per oz.	£19 10s.	...
d Silicium Bronze Wire ... ... per lb.	1/1	...
r Steel, Magnet, in bars ... ... „	1/-	...
n Tin, Block (English) ... per ton	£150 10s.	30s. dec.
n „ Wire, Nos. 1 to 16 ... per lb.	3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The High-Value Penny.—The proposal to divide the shilling into 10 pence instead of 12, whilst maintaining the values of the shilling and pound unchanged, has been unanimously endorsed by the National Chamber of Trade at its annual conference, and the Manchester Chamber of Commerce has resolved to press it on the attention of the Government. Mr. Harry Allcock, M.I.E.E., M.I.Mech.E., who originated the scheme, has issued a small pamphlet in which its advantages are lucidly set forth. The change could be effected without any State subsidy, and would accelerate the restoration of "penny" prices in numerous instances, the increase in purchasing power of 20 per cent. enabling penny postage, penny telephone messages, penny-a-word telegrams, penny tramcar fares, &c., to be resumed. At the same time book-keeping would be enormously simplified—almost as much as by the adoption of a complete decimal coinage, which would naturally follow without any difficulty or any further change in values, two-pence being one-hundredth of a pound sterling.

Universal Time Indicator.—We have received from the General Post Office a universal time indicator that has been issued in connection with the Imperial telegraph cable route. It consists of a cardboard clock dial, the centre of which is movable. Round the edge of the centre disk are printed the names of various foreign places, and to find the time at any of the latter the user turns the inner disk until his local time is brought opposite the name of his own county or city; he then reads the time from the clock dial opposite the place required. The indicator is easily manipulated and should be found useful by many.

EVAPORATORS FOR POWER-HOUSES.

By REGINALD O. KAPP, B.Sc., A.M.I.E.E.

The usual method of dealing with harmful impurities in boiler-feed make-up water is filtration and water softening by chemical means. The chemical treatment of the water is primarily designed to eliminate scale-forming salts, but a subsidiary result of such treatment is that the precipitation of these salts causes finely-suspended solids to coagulate and be retained by a filter which would otherwise allow them to pass in the untreated water. With chemical treatment one can, moreover, ensure that the boiler feed water is neutral or slightly alkaline, thus avoiding any corrosion due to free acids. The chemical method is sufficiently good for most practical purposes, but it is not an ideal method. It consists in replacing harmful impurities by less harmful ones. It does not give really pure water. If the raw water contains a very large quantity of impurities, if some of these are of a nature that cannot be dealt with by water-softening plant, such as common salt, oil, soap, or organic acids, and if the hardness of the water varies, such as is the case when the supply is taken from a tidal river, filtration and water softening do not provide a satisfactory solution of the problem. In such cases even frequent blowing down and cleaning of boiler tubes does not entirely prevent damage to boilers and plant.

A list of the well-known troubles due to unsatisfactory make-up water is sufficiently alarming. Inorganic salts form a hard scale on the boiler tubes, leading to inefficiency of the boilers, pitting, and even burning through of the tubes. Organic acids and free carbon dioxide corrode the boiler and economiser tubes. Solids in suspension choke up the tubes, and if these solids are of a foam-forming kind they lead to priming with possible damage to the steam turbines. Impurities in the water may further lead to corrosion and erosion of turbine blades and incrustation of valves.

An expensive but otherwise satisfactory method of obtaining pure water, whatever the quality of the supply, is by distillation of the raw water.

Though evaporators are more expensive than water-softening plant, both in prime and running cost, the money spent on them is a small item compared with the cost of the boiler and turbine installation in a large power-house. The extra expense is, therefore, frequently justified by the saving in repairs and cost of boiler cleaning, the prolongation of the life of the boilers, and the increased revenue-earning power of the boilers. Apart from the annual overhauling, each boiler is out of commission for a part of its life for periodic inspection and tube cleaning. Where very large boiler units are installed, taking a long time to cool down, this period is a considerable proportion of the boiler's life. It is therefore usual for at least one boiler to be out of service for periodic inspection at any time, and the total steaming capacity installed in a boiler-house must make allowance for this. If periodic inspections can be materially reduced by the use of evaporators, a saving in the total installed boiler plant is effected which is much greater than the cost of the evaporating plant.

When pure water is fed to the boilers the amount of blow-down necessary is also reduced to a very small figure. But the economic advantage of this should not be unduly stressed, as it is doubtful if the value of heat units lost by blowing down a large boiler frequently will amount to more than £20 or £30 annually.

An evaporator is a combined boiler and condenser. If the boiler part were to consist of one or more coal-fired boilers, the apparatus would be too bulky for practical purposes in the case of a large station, and it would cost too much in upkeep and running charges. The usual type of apparatus, therefore, employs steam to produce evaporation of the raw water, and this enables it to be specially designed for a large "throughput," and so arranged that all or nearly all the impurities in the water are got rid of in special sludging vessels and not deposited on the surfaces designed to transmit heat.

Three sources of steam may be available in a power-house, namely, live saturated boiler steam, steam bled from a low stage on the turbines, and exhaust steam from station auxiliaries. As, for reasons of economy, modern practice is usually to design power-stations with motor-driven auxiliaries and bled steam for feed heating rather than with steam-driven auxiliaries, the exhaust steam of which is used for feed heating, the third source of steam is not considered in this article.

The most economical source of steam for evaporators is bled steam from the turbines. It has, however, certain drawbacks. The pressure is often below that of atmosphere, and the evaporators with the pipes and valves connecting them to the turbines are a fruitful source of air leakage. If evaporation is carried out below atmospheric pressure, special air pumps are necessary to draw off the permanent gases in the water. The actual pressure and temperature of bled steam varies with the load on the turbines, and these variations may interfere with the efficient working of the evaporator. In cases where the above reasons do not operate, bled steam, which has already given up the greater part of that portion of its energy which can be turned into work, but still contains a considerable amount of heat energy, should be used.

Apart from losses due to radiation and to the heat contained in the concentrated sludge water, all the latent heat in a given quantity of steam is used to evaporate water, the result being steam at a slightly lower pressure and temperature than that of the steam utilised by the evaporator. A portion of this resultant steam can be condensed in a feed heater in which the incoming raw water is heated to boiling point. Only a portion of the latent heat in the steam can be used in this way, and so there is a surplus of uncondensed steam. There are three possible uses for this surplus steam:—

1. It can be condensed in a further feed heater through which the main boiler feed passes.

2. It can be used as the source of heat to a second evaporator in which the raw water will be turned into steam at a still lower pressure and temperature.

3. A portion of it can be mixed with the steam forming the original heating agent, the mixture being at a higher temperature than the steam given off by the raw water, and therefore able to give up its latent heat to evaporate a further quantity of raw water.

With the second alternative about twice as much water is evaporated for a given supply of steam as in a single-stage evaporator and a smaller amount of surplus uncondensed steam is left over. This can either be condensed in a feed heater as mentioned under 1 or used to evaporate a further quantity of raw water. With each additional stage there is more raw water to be heated up to boiling point, so more surplus steam can be condensed, and generally five stages suffice to condense all of it in feed-heaters.

Where bled steam is used the evaporating plant need only have sufficient stages to reduce the quantity of surplus steam to an amount which can be condensed in feed heaters through which the condensate from the main condensers passes. As the station engineer would prefer to work his evaporating plant at periods of light load, to keep down the load on his boiler-house, the number of stages may be determined by the amount of condensate extracted from the condensers at light load periods.

If live steam from the boilers has to be used it is important to keep the steam consumption of the evaporator as low as possible by installing enough stages to recondense in the plant itself all or as much as possible

of the surplus steam. There is an apparent paradox here. Although a single-stage evaporator takes more live steam, any heat in this which cannot be utilised in the plant itself appears in the surplus steam and can be regained in feed heaters, thereby reducing the amount of steam to be bled from the turbines for feed heating. As a single-stage plant has less radiation losses than a multi-stage plant the heat balance is more favourable for the former. The reason why, in spite of this, multi-stage evaporators are more economical where live steam is used, is that the heat regained from surplus steam constitutes a saving in bled steam from the turbines only, that is, in steam which has already done about two-thirds of its work. In comparing different evaporators for live steam from the point of view of station economy, therefore, the thermal efficiency must not be taken, but the consumption of live steam, less the bled steam saved, expressed in terms of the amount of live steam equivalent to it.

Let A = lb. of steam at boiler pressure required to give 1 lb. of gained distilled water.

h_1 = difference in temperature between the distilled water and the crude water.

h_2 = the heat units given up by the surplus steam per lb. of gained distilled water.

L = the heat units available for feed heating in 1 lb. of bled steam.

r = the ratio of work obtainable from 1 lb. of bled steam to that obtainable from 1 lb. of live steam.

The actual extra live steam that has to be supplied from the boiler-house per lb. of gained distilled water is:

$$A - r\,(h_1+h_2)/L.$$

The value r is of the order of one-third, and depends on the pressure and superheat of the live steam, the vacuum in the condenser, and the stage of the turbine at which steam is bled.

An evaporator heated with saturated steam is a very much smaller object than a boiler of the same steaming capacity. The principal reason for this is that a much better heat transference can take place across evaporator tubes than across boiler tubes. The boiler tube is surrounded by a layer of somewhat cooler gas, which forms a good non-conductor of heat, and the principal temperature gradient is in this gas and not in the metal of the tube. In an evaporator this film is replaced by a thin film of water of much greater heat conducting power than a gas film. As evaporators work with a small difference of pressure on each side of the tubes, the metal can be very thin, which further helps the heat transference. Many types of evaporator have a very great velocity of water in the tubes; this may be as much as ten times the velocity of the water in a water-tube boiler. At such high velocities the film of badly-conducting steam on the inner surface of the tubes is avoided or reduced to a minimum, and the temperature difference between the heating steam and the water to be evaporated is still further reduced. In the case of the Kestner climbing film evaporator, this high velocity is obtained by the use of very long tubes. It is found that the steam, as soon as it is formed, is carried to the centre of the tube, leaving the inner surface always covered with a film of moisture which rises more slowly than the steam. In the Prache and Bouillon type of evaporator a high velocity is obtained by the use of an impeller. This adds a slight pressure to the water in the tubes, preventing the formation of steam in them. Ebullition does not take place till the water has left the tubes and entered a large vessel called the ebullition chamber. Messrs. Mirrlees Watson also avoid a film of steam on the inner surface of the tubes by the use of ebullition chambers, where the pressure is slightly lower than in the tubes, so that no steam is formed in the tubes themselves.

A most important consideration is the reduction or avoidance of scaling in the evaporator tubes. Clearly little would be gained if scale trouble was only transferred from the boilers to the evaporators and with the great throughput of an evaporator, and because it is entirely fed with raw water, the amount of solids to be eliminated hourly is much greater per unit heating surface than in a boiler. Such trouble is largely obviated by the low pressure and temperature at which an evaporator works. At such temperatures the scale formed is soft and does not tend to form a deposit on the tubes as readily as in a boiler. Evaporators using live steam are often fitted with a reducing valve to bring the steam pressure down to a figure approximating to that of the atmosphere. A small water jet is installed to quench the superheat in the steam issuing from the reducing valve. In the case of the Prache and Bouillon evaporator, the temperature and pressure of the supply steam is lowered by mixing it with some of the steam generated in the plant. As the mixture is superheated it is passed through a kinetic nozzle in which a velocity head at the inlet is changed into a pressure head at the outlet. The nozzle is so designed that the pressure thus obtained corresponds to saturation point for the temperature of the mixture. Thus some of the steam developed in the plant is used to evaporate more raw water, and the effect of a multi-stage evaporator is obtained in one plant. The best efficiency with this method is only obtained at that particular throughput for which the plant is designed. Both in this and in the Kestner evaporator the high velocity of the water in the tubes further helps to minimise scaling, as solids precipitated in the tubes are swept out before they have had time to adhere to the metallic surface. A sudden change in the direction of the liquid after leaving the tubes, causes the solids in suspension to be shot off into sludging vessels. In the Prache and Bouillon evaporator scaling is further avoided by the introduction of a small quantity of sand which exerts a scouring action on the tubes, but seems to cause remarkably little erosion of the metal itself. Other makers rely on a design in which tube-cleaning is rendered as simple and speedy as possible.

The efficiency of evaporating plant is of the utmost importance, as in general the capitalised value of the extra coal used is comparable to the capital cost of the plant, and will be the greater of the two figures in the case of plant employing live steam. A rough figure for the best output that may be expected from a multi-stage plant employing live steam is 4 lb. of gained distilled water per lb. of steam.

THE TRADE OF AUSTRALIA.

[Imports and Exports.]

The following figures, showing the values of the imports of electrical and allied goods into Australia in 1920-21 are taken from the recently-published official trade returns. For purposes of comparison the figures for 1919-20 are given, and notes of increases or decreases are made. Only in the case of cables is it possible to indicate any unit other than value.

	1919-20. £	1920-21 £	Inc. or dec. £
Gas and oil engines.			
Total	255,000	435,000	+ 180,000
From United Kingdom ...	133,000	237,000	+ 104,000
,, Canada	11,000	32,000	+ 21,000
,, United States	99,000	156,000	+ 57,000
,, Sweden	3,000	2,000	– 1,000
High-speed reciprocating steam engines (direct coupled).			
Total	4,000	3,000	– 1,000
From United Kingdom ...	4,000	3,000	– 1,000
Dynamo-electric machines, static transformers, induction coils, electric fans and parts thereof.			
Total	731,000	1,682,000	+ 951,000
From United Kingdom ...	324,000	952,000	+ 628,000
,, United States	390,000	683,000	+ 293,000
Regulating, starting and controlling apparatus.			
Total	125,000	215,000	+ 90,000
From United Kingdom ...	48,000	138,000	+ 90,000
,, United States	74,000	74,000	—
Electric fittings, viz., switches, fuses and lightning arresters.			
Total	174,000	269,000	+ 95,000
From United Kingdom ...	95,000	148,000	+ 53,000
,, United States	71,000	88,000	+ 17,000
,, Japan	6,000	33,000	+ 27,000

		1919-20. £	1920-21. £	Inc. or dec. £
Electric heating and cooking appliances.				
Total		19,000	51,000	+ 32,000
From United Kingdom ...		9,000	19,000	+ 10,000
,, United States		10,000	30,000	+ 20,000
Electrical appliances, other.				
Total		323,000	808,000	+ 485,000
From United Kingdom ...		107,000	383,000	+ 276,000
,, United States		153,000	71,000	+ 82,000
,, Netherlands		29,000	100,000	+ 71,000
Telephone apparatus.				
Total		99,000	256,000	+ 157,000
From United Kingdom ...		34,000	63,000	+ 29,000
,, United States		59,000	162,000	+ 103,000
,, Sweden		—	27,000	+ 27,000
Accumulators or storage batteries.				
Total		128,000	107,000	− 21,000
From United Kingdom ...		44,000	48,000	+ 4,000
,, United States		81,000	58,000	− 23,000
Arc lamp carbons.				
Total		13,000	10,000	− 3,000
From United Kingdom ...		4,000	7,000	+ 3,000
,, United States		3,000	2,500	− 500
Arc lamps, carbon in blocks, vacuum tubes, measuring and recording instruments, insulating tape.				
Total		138,000	272,000	+ 134,000
From United Kingdom ...		65,000	154,000	+ 89,000
,, United States		48,000	76,000	+ 28,000
Lamps and lampware.				
Total		169,000	378,000	+ 209,000
From United Kingdom ...		50,000	113,000	+ 63,000
,, Japan		19,000	67,000	+ 48,000
,, United States		90,000	171,000	+ 81,000
Steam turbines, economisers, superheaters, &c.				
Total		139,000	221,000	+ 82,000
From United Kingdom ...		109,000	218,000	+ 109,000
,, United States		21,000	3,000	− 18,000
Cable and wire, covered.				
Total ...	Tons	3,740	6,300	+ 2,560
	£	631,000	1,233,000	+ 602,000
From United Kingdom	Tons	2,955	5,900	+ 2,945
	£	532,000	1,181,000	+ 649,000
,, Canada	Tons	148	9	− 139
	£	14,000	1,700	− 12,300
,, Japan	Tons	327	17	− 310
	£	51,000	7,500	− 34,500
,, United States ...	Tons	300	376	+ 76
	£	34,000	37,000	+ 3,000

It is interesting to note that Australia has made a beginning in the export of electrical machinery and appliances. The values of such goods, of Australian manufacture, are given below :—

Machinery and appliances, electrical.			
Total	12,000	20,000	+ 8,000
To New Zealand	6,500	11,000	+ 4,500
,, Fiji	3,000	4,000	+ 1,000
,, Papua	1,000	—	− 1,000
,, India	—	1,500	+ 1,500
,, South Africa	—	1,100	+ 1,100
Electrical materials.			
Total	12,000	68,000	+ 56,000
To New Zealand	10,000	66,000	+ 56,000
,, Fiji	1,000	1,600	—

THE ART OF GETTING A JOB.

IN the *Proceedings* of the American Society of Civil Engineers for May, 1922, it was stated by the manager of the Federated American Engineering Societies' Employment Service that a period of marked betterment had set in. The Unemployment Service had placed 870 men in engineering positions since January 1st, 1922, and from 10 to 15 professional engineers a day were finding places.

About 3,000 applications were on file at the Unemployment Service. Volunteer committees of engineers to aid in finding jobs for members of the profession were at work in various cities of the United States, and were making marked progress in extending the scope of the engineer to new fields.

The following admirable "Suggestions from the Voluntary Committee of the Employment Service" we quote in full, in the hope that they will be useful to some of our readers :—

The experience gained by interviewing hundreds of employers and thousands of employés seems to prove that the average job hunter passes through three stages before making a new connection.

The first may be likened to that of a chicken which has recently been deprived of its head. First, comes the severing blow of discharge, followed quickly by a wild spattering of messy letters, fit only for the waste basket, and a mad aimless rushing hither and thither after jobs for which he is unfitted. Should anyone dare to offer the kindly suggestion that he is reaching for something beyond his grasp, the applicant sees a diabolical attempt to keep him out of work and bull-headedly insists on having his way, blindly ignoring the fact that he is wasting his time and hurting the bureau.

Meeting with no success, he is overcome with an enervating feeling of maudlin self-pity, and proceeds to give an excellent imitation of Sir Isaac Newton discovering the law of gravity. Although the achievements of great scientists are always worthy of imitation by engineers, there is little chance these days of a job falling into the lap of any man. At this stage he spends a goodly part of his time in composing bitter arraignments of the inefficiencies of the bureau (unmindful, perhaps, of the fact that his contribution toward its support amounts to just 25 cents per year), and is quite firmly convinced that the hand of both God and man is turned against him.

He finally reaches the third stage where he decides to quit imitating the ostrich, withdraws his head from the sand of ignorance and personal prejudice, and faces the cold hard facts. Now something can be done to help him.

To get a job one must sell one's services. Unfortunately, the prospect of having to go out and attempt a sale seems to throw most engineers into a blind unreasoning panic, owing, doubtless to a childlike acceptance of that most fallacious, although generally accepted, statement that an engineer cannot make a good salesman. Surely a man who understands human nature, knows his goods, thoroughly believes in them, and displays a reasonable amount of enthusiasm in presenting them, should stand a good chance of making a sale. The trouble with the engineering job hunter is that he does not know his goods, consequently he has not a strong belief in them, and instead of presenting them with a show of sincere enthusiasm, tries to cover these defects with a bluff, appearing, therefore, either as a "know it all" or a charity seeker.

When an employer desires a man to fill a specific opening he always has a well-defined idea of the kind of man he wants, and that applicant is successful who most closely approximates to that ideal. True it is that one occasionally meets a man who seems not to know what he wants—and this is really the easiest type of man to deal with if the applicant knows and believes in himself. The employer's nebulous ideas can often be crystallised into a form according almost exactly with the qualifications of the applicant. Unfortunately most applicants seek merely a certain salary, and are ready to take almost any kind of a job which will pay it. Hence, to a prospective employer they appear weak, doubtful of their own capabilities, and create a negative impression on him. Remember, always, that when a man is hired a contract is made, and a contract has been well defined as "a meeting of two or more minds." How, then, can two minds meet when only one of them has a well-defined set of ideas? Therefore, the first thing for a man to do is to draw up a detailed list of his qualifications—personal, educational, practical. Let him only play fair with himself and note both strong and weak points. Here, he begins to make progress, for ambition will force every normal man to seek remedies as soon as he recognises his weaknesses. Next, he should combine this detailed list of qualifications into a clear, concise, forceful experience record which will show him in the best light possible. This is the hardest part of the whole task, and will require not an hour, but more often days of hard, consistent, even painful effort. When properly done, however, it creates a wonderful feeling of confidence, and gives him a sharply-defined idea of his size as pertaining to any job he seeks. As a result he no longer wastes his time and efforts in madly chasing impossible jobs, but settles down to a determined and a frequently much more successful hunt for a job within his capabilities.

Incidentally, this is an ideal time to take some thought of the future and decide what one would like to be ten or twenty years from now, thus gaining an idea of how far one has progressed along the desired path, and what steps must still be taken to attain the goal. One should set up a high standard, but not an impossible one; and what that may be each man must determine for himself. This mode of procedure enables a man to make a progressive effort to gain a job which is within reason and which will enable him to gain additional valuable experience. He has now reached the point of knowing what he wants, why he wants it, and why he should have it. A man in possession of these facts is a hard individual to turn down, and what is more important, he has acquired confidence.

Logically, the next step is to find a market for the goods. This is where the bureau, advertisements, letters, and personal tips should be used. Bear in mind these are media only, and none of them will or can get the job itself, they merely place one in touch with it. Most jobs, and particularly the good ones, are "By Letter," so it behoves the applicant to give heed to what constitutes a successful letter.

Avoid wasting a paragraph or even a sentence telling how the job was located—the heading does that. Set forth the qualifications in general, but forceful, terms—the experience record will give the details and proof. Above all, be con-

cise, for if you really know you will fill the job your letter will show it. No man not a genius can dash off an effective letter in an hour. A successful letter is well worth several hours of effort. Even after composing what appears to be a good letter its value must be tested in the open market—and the first attempt is rarely successful. Persistence plus knowledge and confidence must inevitably win.

Finally comes the interview. Its success will be dependent on the personal impression, an intelligent expression of requirements and qualifications, and mutually satisfactory terms. Physical appearance counts for a great deal. Some are naturally gifted, others are not. One's natural inclinations usually tend toward work with which his physical appearance accords. One does not pick a dray horse for the race track. Therefore, look to the neatness of clothes, face, and shoes, and let the guest beware of his manners. Watch carefully the questions and answers, as the tongue has often slipped many a man out of a good job. Lastly, endeavour to be reasonable in one's demands, for if the employer does not use good business judgment in dealing with the employé the latter will not long have a job. The following summary will probably be more effective than the foregoing remarks. In any event it is hoped that either or both will make a few of the job hunters think.

Hints on Job Getting.

1.—Decide on what you want.
2.—Make sure your qualifications give you an even chance of getting it. Do not think 100 per cent. is necessary. Perfection does not exist.
3.—Do not go after a job unless you mean business.
4.—There are three factors to every job, viz., advancement, experience, salary. Do not ignore the first two.
5.—Remember that the job gets the salary, not the applicant's qualifications.
6.—Job getting is selling one's services. The successful salesman knows his product thoroughly. Study your goods.

Letter Writing.

1.—The object of a letter is to get an interview. Letters do not get jobs.
2.—Padding of payrolls is a felony. Padding of letters is equally dangerous for the job hunter.
3.—A letter must: Arouse interest; create desire; prove the case; and convince the reader that an interview will be profitable. Therefore: Be as brief as is consistent to prove your claims. Make no claims not backed by the experience record. Always include the experience record.
4.—Attractive packages improve the sale of goods. Therefore, typewritten letters on plain business stationery are better than long-hand letters on club or personal stationery.

Interviews.

The interview is "the day in Court." Getting it is only one-half the battle. When being interviewed:
1.—Be confident of your worth, but not presumptuous.
2.—Be sure you want the job and be ready to prove why you should get it.
3.—Ask a fair market price for your goods. Do not profiteer. Do not be a philanthropist.
4.—Assay the three elements: Advancement, Training, Salary, and be guided by the sum of the three in accepting or declining.
5.—Leave in a pleasant, hopeful manner if the job is not decided then and there.
6.—A letter of acknowledgment of the courtesy of an interview is good policy following a promising call.

Finally, maintain the proper mental attitude. Do not let your morale slump. No one wants a grouch or a man who is not sure of himself.

ELECTRICAL DEVELOPMENT IN NEW ZEALAND.

The Report of the Chief Electrical Engineer (Mr. L. Birks, B.Sc., M.I.E.E.) for the year 1921 has recently come to hand. It is a mine of information, and it is not possible in the space available to do more than refer briefly to a number of the interesting features which it possesses.

The immediate aim of the Government, it is stated, is to secure a supply of 0.2 h.p. per head of population, but this does not represent the ultimate development. To carry out this aim in the North Island, a scheme was laid out involving 1,112 miles of main transmission lines and 309 miles of branch lines, with transmission pressures of 110,000 V for main and 33,000 V for branch lines. The three main generating points are Mangahao (24,000 h.p.); Waikaremoana (40,000, ultimately 136,000 h.p.); and Arapuni (96,000, ultimately 162,000 h.p.). These undertakings are to be linked up with a number of smaller existing hydro-electric stations. The estimated cost of the scheme was £7,303,042, or £45.63 per h.p., but the actual costs have been found to be over 50 per cent. in excess of estimates. The present position of the scheme is summarised as follows:—*Mangahao.*—The headworks have been proceeded with during the year, but owing to falling costs, fresh tenders have been invited. Specifications for the balance of the plant have been ready for some time, but the state of the market rendered it advisable to wait. Tenders were accordingly invited during the year, and closed on November 29th. The transmission line poles are being delivered. *Arapuni.*—Further investigations have been carried out, and the construction of the dam is now to be proceeded with. *Waikaremoana.*—The power house surveys have been continued and roads and bridges proceeded with. Two permanent 500-h.p. exciter units have been ordered; these will supply the power for the construction of the permanent works and other immediate purposes. The Horahora plant (8,400 h.p.) and main transmission line have been purchased from the Waihi Gold-mining Co. for £212,500. This plant is to be extended by the addition of two 2,600-h.p. (2,000-kW) sets, for which water-power will be available except in very dry years. Surveys have been carried out on a number of other sites.

Development in the South Island is proceeding more slowly, but sufficient information is now available to enable a comprehensive scheme to be drawn up for the Canterbury, Otago, and Southland districts. This will be a 66,000-V transmission system with a total length of 759 miles, or an equivalent of 1,116 miles of single line. To meet the requirement of .2 h.p. per head of population, an installed capacity of 110,000 h.p. will be necessary. For the more sparsely-populated areas an additional 15,000 h.p. will be required. Details are given of

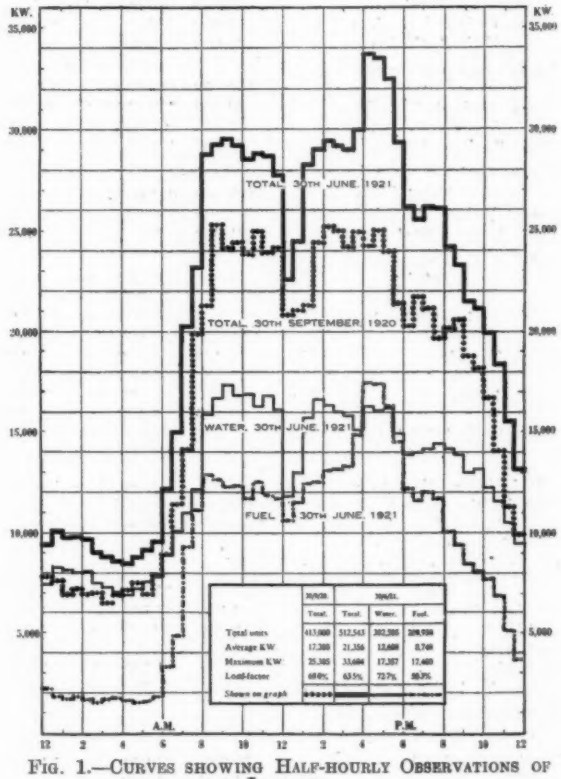


Fig. 1.—Curves showing Half-hourly Observations of Loading.

the extensions to and the working of the Horahora plant. The total capital outlay to the end of 1921 amounted to £249,745. The result of working was a loss of £6,341. The operation of the Lake Coleridge system (South Island) was more successful; after meeting all charges, the result was a credit balance of £3,447, on a revenue of £51,373. The capacity of this undertaking was increased during the year by the addition of a 3,000-kW set. The erection of a third pipe-line is in hand, and a commencement has been made upon the installation of a third transmission line between the station and Christchurch.

Apart from the two main Government supply systems, there are fifty-five power supply stations in the Dominion, representing 49,630 kW of main plant and 5,831 kW of subsidiary or stand-by plant. The total maximum output of these stations increased during the year from 30,716 to 42,157 kW. The majority of these undertakings (41) are owned by municipal authorities.

The position as regards standardisation of supply remained practically the same, but several of the older installations are preparing to change over to the standard 3-phase, 50-cycle system, which now includes 29,980-kW, or 54.3 per cent. of the generating plant installed in the Dominion.

In order to determine the distribution of the load over the various hours of the day, arrangements were made with the

engineers of the fifteen largest undertakings, comprising 78 per cent. of the plant capacity of the Dominion, to take half-hourly observations of the loading on September 30th, 1920, and June 30th, 1921, as representing typical equinoctial and mid-winter loading. The results are shown in the accompanying graph (fig. 1). It is rather surprising, says the Report, that even under present New Zealand conditions the all-day demand is so high, and with the large development of hydro-electric power and the consequent increasing industrial and cooking load, the evening demand will become a still smaller proportion of the daily peak load. It will be seen that the load factor in both cases was very high. The Report then gives a summary of results of working of the whole of the undertakings in New Zealand, of which there are 57—water, 26; steam, 10; gas, 19; and oil, 2—representing a capacity of 55,461 kW. These showed a total revenue of £781,939, and the net result was a profit of £68,106. Full details of each station are given in tabulated form, from which it is seen that most of the steam stations (including Auckland, Wellington and Invercargill) made profits, while the majority of the gas stations incurred losses. As regards the hydro-electric stations, the total profits amounted to £52,338, while the losses only totalled £8,115. The net selling prices vary a great deal, but upon the whole appear to approximate to those in this country.

The number of electric power districts constituted under the Electric Power Boards Act, of 1918, is now fourteen, but many others are to be formed. These districts are the smallest units in the scheme of supply and distribution, and it is laid down that the demand in such districts should be at least 1,000 h.p., yielding a revenue of £15,000 per annum, and involving a population of about five thousand.

In conclusion, the Report gives full details regarding population and existing plant of a number of electric power districts which it is considered desirable to constitute. The list consists of twenty-seven in the North Island and fourteen in the South Island.

The Report clearly shows that every effort is being put forward to make full use of the benefits of electricity, and to develop to the full all natural sources of power.

ELECTRICITY SUPPLY AT SHANGHAI.

ANNUAL REPORT.

ACCORDING to the annual report for 1921 on the year's working of the Shanghai Municipal Council's electricity undertaking, of which Mr. T. H. U. Aldridge is engineer-in-chief and manager, the capital outlay on the undertaking at the end of the year had reached Tls. 20,771,496* (£3,461,911), and the return on the capital outlay on the plant in operation at the end of 1921 was 10.56 per cent. The gross profit for the year was Tls. 1,863,610 (£310,602) and the net profit after provision for interest on loans, depreciation, &c., was Tls. 1,047,608 (£174,601). From 1916 to the end of 1921 a sum of Tls. 2,170,000 (£361,667) had been added to the Council's general fund out of the profits on the electricity undertaking.

The past year has been a record one, both as regards the profit made on invested capital and the number of kilowatt hours sold. Although the Riverside power station is not yet working under ideal conditions, nevertheless great improvements have been effected, and the thermal efficiency of the plant has been augmented; finality has not yet been reached in this respect, however.

The generating plant at Riverside power station has been increased by 46,000 kW. On March 15th, the first of the two 18,000-kW turbine sets was commissioned; the second was commissioned on August 11th; on November 12th a 10,000-kW turbine was put into service, and by the end of the year the installed plant capacity at Riverside totalled 79,000 kW. When the two additional 20,000-kW turbines are ready for service, together with the two 3,000-kW machines for providing an independent supply of electricity for operating the auxiliary plant in the power house, it will be possible to dispense with two of the smaller machines, which are each of 2,000 kW capacity, and when this is accomplished the plant capacity will amount to 121,000 kW. It is anticipated that this condition will obtain during 1923, and it should then be possible to entirely eliminate the old Fearon Road generating station, which contained, at the end of the year, 5,600 kW of plant.

It may be a surprise to some to realise that Shanghai sold very nearly as much electricity as the Manchester electricity department, which is the largest municipal undertaking in Great Britain, the figures being 185,364,746 and 199,618,813 kWh respectively.

During the period under review the amount of overhead cable erected reached a total of 167.64 miles, and 65.57 miles of underground cable was laid. All this work was carried out entirely by the department's staff. The average capacity of the modern substations is about 2,000 kW, although for special purposes, such as the supplying of large mills, substations considerably larger than this have been equipped. In addition to these more or less standard substations there is the Tonquin Road super-substation, which is already supplying a demand of 20,000 kW, and is being equipped to deal with a total of 50,000 kW. At Robison Road a large switch house has been completed, which is designed for ultimately handling 28,000 kW. The department is now supplying electricity to 33,334 premises, a net increase of 2,692.

The foreign staff at the end of the year numbered 135, and the Chinese staff 2,797. The highest maximum load which occurred simultaneously at the two stations was 43,554 kW. The load delivered to feeders was 41,074 kW, an increase of 16 per cent. over the previous year. Due to the partial failure of the year's wheat crop, many of the flour mills were shut down, or working only on short output. Then again, late delivery of textile machinery prevented new cotton mills from spinning. Had the anticipated maximum demand on the power house been realised it would have been possible to meet it, but not with a sufficient reserve of boiler plant. Steps were taken during the year to install oil-burning equipment for the eight boilers in the No. 2 boiler house. Experiments proved that by supplementing the coal-fired boilers with oil burners the steaming capacity of the boilers could be raised by about 25 per cent., and it has been decided to retain the oil-burning plant as part of the permanent equipment for emergency purposes. The load factor improved from 46.7 per cent. to 51.5 per cent. The total kWh generated at both stations amounted to 226,418,958, of which Riverside accounted for 219,251,888, and Fearon Road for 7,167,070. The total kWh sold increased by 28.24 per cent. to 185,364,746, as follows: private lighting, 1,703,212, a 17.07 per cent. increase; heating and cooking, 1,311,970, a 5.97 per cent. increase; power 154,898,657, a 32.57 per cent. increase; and traction 4,992,282, a 6.06 per cent. increase.

The new connections added during the year amounted to 10,519 kW, excluding street lighting and traction. The increase in new industrial power demands fell below the estimated figure, but the demands for electricity made by undertakings already in commission exceeded expectations by a notable amount. Regarding motors connected an increase of 9,900 h.p. is to be recorded, an increase which ranks only second to the 1920 record, *i.e.*, 12,242 h.p. Notwithstanding this maintained increase in motor installations the horse-power of motors hired from the electricity department shows a steady decrease. This clearly indicates that users are satisfied that they are justified in sinking capital in the purchase of their own motors. The continuance of the facilities for motor hiring is, nevertheless, essential, in that means of utilising electric power is thus placed in the hands of those who have insufficient capital to allow of the purchase of a driving medium.

To summarise, it is safe to say that the close of the year 1921 leaves a record of a satisfactory increase in industrial demand for electricity, coupled with a well maintained tendency towards consolidation and the putting of industrial undertakings upon a sounder basis for economical production than was the case in immediately previous years, when the one aim was "production," and "production" only, at any cost.

A steady advance has to be recorded in connection with electric heating and cooking, although the enforced continuance of relatively high supply rates might reasonably be expected to retard progress. Increased activity has been particularly marked so far as demands for heating and cooking plant hired from the department are concerned, and notwithstanding the holding of largely augmented stocks of radiators for hire, the demand once again exceeded the supply, 1,769 radiators being issued during the year. The result of the department's policy in increasing the size of hired radiators from 2 to 3 kilowatts has been that the selection of the larger size by the consumers is almost invariable. Satisfaction with its capacity for economical heating has been freely expressed. Apart from cookers purchased by consumers, a number of ranges has been hired from the department during the year. It is freely recognised that the characteristics and customs of the Chinese cook impose a heavy handicap upon any departure from the use of the coal range. Consequently the progress recorded may be regarded with enhanced satisfaction.

The extensions at the Riverside power house have not progressed as rapidly as might be desired. The two main causes are—the amount of detailed constructional plans which had to be prepared before building contracts could be let and work commenced; and the labour shortage.

Generally speaking, with some exceptions, manufacturers in England and the United States have successfully met their obligations to supply the new plant contracted for.

*Taels converted at the exchange rate of Tls. 1 = 3s. 4d.

A G.E.C. Success.—During a recent "Shopping Week" at Cardiff traders were asked to participate in a pageant typifying their various specialities. The Cardiff Branch of the General Electric Co., Ltd., entered a display consisting of a chariot bearing a large model of an "Osram" lamp, drawn by members of the staff concert party in appropriate costume, which secured the first prize. The third prize was obtained by another tableau arranged by the G.E.C. staff.

"ENGLISH ELECTRIC" WATER-POWER ACCESSORIES.

The attention which is being devoted to the development of the world's water-power resources renders any new designs in plant or accessories of the utmost interest and importance, and when these are brought forward by British manufacturers it is a sign that this country is fully alive to the possibilities. Although we ourselves do not possess large water powers capable of development we hope to participate very largely in the orders from other countries more fortunately situated in this respect.

Fig. 1.—The English Electric Bucket Attachment for Impulse Wheels.

We have received from the English Electric Co., Ltd., some details of accessory hydro-electric gear which the company is putting on the market, consisting of a relief valve, a cylindrical balanced valve, and a bucket attachment for impulse wheels.

The buckets are the most important part of an impulse wheel, and their design and method of attachment make all the difference between success and inefficiency. They must be so attached as to resist both the centrifugal forces and the repeated impact of the jets without any possibility of backlash developing. The English Electric method is shown in figs. 1 and 2. For each bucket there is a tapered forged steel bolt passing through a bush of chrome nickel steel, the external surface of which is cylindrical, while its interior is tapered. The bush is split longitudinally along its whole length, except at the thin end, which is threaded for receiving the nut. The holes through the disk and lugs of the bucket are therefore cylindrical, so that spare buckets can be completely finished in the shops, and are interchangeable without difficulty. The split bush and the tapered bolt are both provided with threaded nuts, which, when tightened, result in the bush expanding and tightening against the walls of the cylindrical hole; the force due to this taper is considerably greater than that exerted by the jet. At the same time the lugs of the bucket are tightened by the nuts securely against the two faces of the disk. These nuts are secured by locking washers, which are bent over the end of the lug and the face of the nut. The back of every alternate bucket butts against a fixed key (B) (fig. 2). These keys are fitted into dovetail slots in the circumference of the disk and electrically welded. The two buckets between each pair of keys are finally tightened up by means of two tapered keys (A), which, when put together, present parallel faces to the bucket surfaces. The small ends of both these keys are bent at right angles against the bucket surfaces, and are thus prevented from working loose. By this means the buckets are rigidly tightened against the fixed keys, and the circle of buckets sustains the blows of the jet as a solid mass.

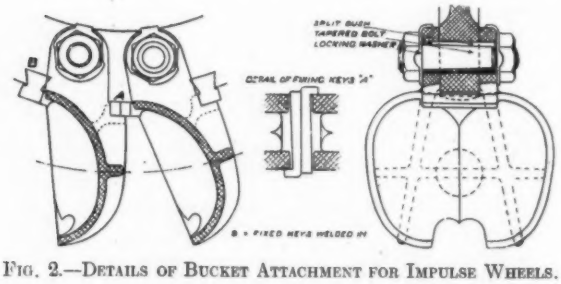


Fig. 2.—Details of Bucket Attachment for Impulse Wheels.

The company's cylindrical balanced valve is constructed with a view to simplicity and compactness. The piston, which is a cylindrical piece, constitutes also the closing apparatus. The piston is easily accessible without removing the valve by taking away an inspection ring made in halves, and consequently the supervision of the vital part of the valve is very easy. The internal body of the valve is fitted with a by-pass, thus avoiding the necessity for an external by-pass and piping, and thereby reducing considerably the space required in the trench. There are no cup leathers used in the water stream; the piston is provided with accessible stuffing boxes. As shown in fig. 3, the valve consists of an inner body surrounded by an outer casing, secured to each other by a series of strong webs. Feet are provided

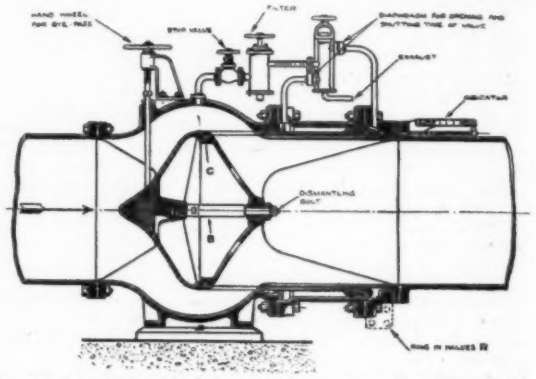
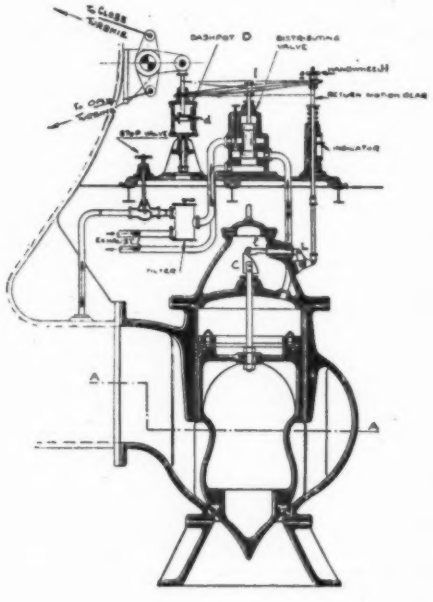
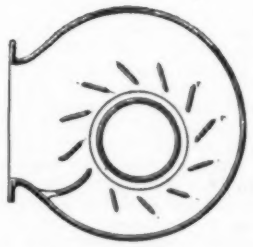


Fig. 3.—The English Electric Cylindrical Balanced Valve.





Sectional Plan on AA.

Fig. 4.—The English Electric Relief Valve.

for fixing the valve to the ground. The piston-valve consists of a sliding cylinder of forged non-rusting steel, bearing, when closed, against a gunmetal ring securely fixed against the inner valve body. This piston-valve surrounds the gunmetal lined cylinder, which is secured by a series of ribs to one part of the inner body. These ribs, together with the inner cylinder, form an excellent guide for the piston-valve, the head of which slides in a differential servo-motor chamber, and is provided with packing. The by-pass is placed in the up-stream end of the inner valve body, and is actuated directly from the outside by a hand-wheel, the spindle of which passes through a stuffing box. The by-pass valve is faced with gunmetal and slightly tapered to ensure a water-tight seating. The main valve, being balanced, can be opened and closed without the by-pass. The indicator consists of a rod attached directly to the piston-valve and passing right outside through a stuffing-box. In operation water under pressure is led from the top of the valve, which serves at the same time as an air escape to a stop valve, from which it enters a round filter, which can be cleaned while the valve is either open or closed. The filtered water is led to a gunmetal distributing valve, from which the water under pressure is guided to one side or the other of the servomotor, according to the position of the hand-wheel working the distributing valve, or that of the switch in the case of electrical control from a switchboard. The shutting and opening time of the valve can be regulated by means of diaphragms inserted in the pipes between the distributing valve and servomotor.

The English Electric relief valve provides for automatic control by the governor, which, in the event of a sudden drop in load, shuts the guide apparatus, at the same time opening the relief valve to prevent an undue pressure rise. It destroys the energy of the jet by the production of a whirling movement immediately before it escapes by dispersing the jet in a hollow conical screen. Fig. 4 shows the valve connected to the regulating shaft. The action is as follows when a sudden drop in load occurs: the dashpot (D) is lifted up by its piston, the oil being prevented by a diaphragm (d) from passing from one chamber to the other, consequently point 1 is lifted, and therefore the distributing valve also. The water in the pressure chamber of the main piston is thus connected to the exhaust, and the pressure of the water on the other face of this piston pushes it up, so that the relief valve opens and releases the water to the tail-race. Following the movement of the piston, the cam (C) travels upward, thus transmitting the compensating movement through the roller (*l*) and the lever (L) to the point marked 2. The whirling motion is imparted to the jet by the ribs (*rr*), shown in the sectional plan view in fig. 4, which are set at an angle to the radial direction.

POWER SUPPLY FOR THE SOUTH-EASTERN & CHATHAM RAILWAY.

Electricity Commissioners' Inquiry.

(*Continued from p.* 801.)

On Wednesday, June 7th, Mr. W. E. Tyldesley Jones, K.C., dealt with the case for the West Kent Electric Co. In 1918, he said, the company acquired a site at Belvedere, with the intention of erecting a big generating station to meet, not only the demands anticipated in its ordinary area of supply, but also a large railway load. The site was acquired at a cost of £29,272, and that figure was in the accounts of the company to-day. The company believed that it would be possible to supply the South-Eastern & Chatham Railway Co., whose electrification, it was thought, must come about directly after the war. On July 7th, 1919, the company applied to the Board of Trade, under the Electric Lighting Act of 1909, for the Board's formal consent to the construction of a generating station on that site, but consent was not obtained. Counsel quoted a letter from the West Kent Co. to the railway company, dated October 31st, 1919, in order to show that at that time it was endeavouring to come to terms with the railway company for a supply of energy. Continuing, counsel said that there were interviews with the railway company in 1920, and letters were exchanged, in which the railway company invited the West Kent Co. to make an offer for the supply of energy, pointing out, at the same time, that nothing had been settled with regard to the electrification of the railway. But the railway company had taken care to intimate to the West Kent Co. that it had reached very definite conclusions about the possibility of the West Kent Co.'s ability to supply on favourable terms; the railway company was certain that the West Kent Co. would not be able to quote a figure which it could accept. The West Kent Co., said Counsel, had throughout refused to quote a figure, but had suggested a principle for agreement. The company could not quote a figure because the market was so unstable, and the prices quoted could not be compared with the prices which could be quoted by the railway company's engineers three months later; it would have been some time before consideration would have been given by the railway company to the figure quoted. Counsel suggested that the railway company was not prepared to discuss matters with the West Kent Co.—unless the latter put down a figure on paper. It was absolutely impossible for an engineer to do that. It was significant that the railway company had never, throughout that correspondence, asked the West Kent Co. to show that it was in a position financially to carry the scheme forward. The West Kent Co., therefore, came to the conclusion that the railway company was not taking the matter seriously. The West Kent Co. had ultimately pressed for an interview with the board of the railway company, and managed to get one on April 10th, 1922. Up to this date the railway company had been formulating plans for electrification, and yet no formal report had been made to the board by the railway company's officials on the negotiations which had been taking place with the West Kent Co. If the railway company had been negotiating seriously with the West Kent Co., would there not have been formal reports, and, if the railway company really had intended to discover whether it could not do better by obtaining a supply from elsewhere than by erecting a station of its own, was it not the officials' duty to put before the board a formal report on the matter? But, whatever the attitude of the officials of the railway company might have been, there was no doubt about the attitude of the board. Mr. Cosmo Bonsor (chairman of the South-Eastern Railway Co.) had made it perfectly clear at the interview that the board was not going to take energy from an outside source. With regard to the State guarantee, mentioned by the railway company, counsel submitted that the arrangements made between the railway company and the Trade Facilities Committee were conditional on the Electricity Commissioners approving the railway company's scheme. Further, he submitted that if the Treasury was prepared to guarantee money for the erection of a generating station to supply the South-Eastern Railway, it was quite obvious that, if the Commissioners were satisfied that the generating station should be put up by the West Kent Co., that company was entitled to the same guarantee; it was quite obvious that the Trade Facilities Committee could not refuse such a guarantee to the West Kent Co. The latter had made a formal application to the Trade Facilities Committee, but at the moment the matter had proceeded no further. The West Kent Co.'s case was that a separate generating station should not be erected for the railway supply; the desirability of a combined supply, as a general rule, was admitted. The erection of a generating station could be carried out more quickly by the West Kent Co. than by the railway company, because, before the railway company could commence operations it would have to get an Order from the Board of Trade under the Electrification of Railways Act, 1903, which meant delay, whereas, if the Commissioners gave their consent, the West Kent Co. could go ahead at once, except for an alteration of the agreement with the Trade Facilities Committee.

In the course of a survey of the evidence given by the railway company, Mr. Jones said it had been stated that the railway company could raise money cheaply. It would only get the advantage by reason of the State guarantee, and therefore, if consent were given by the Commissioners, cheap money should also be available to the West Kent Co.

After outlining the evidence which he would call, counsel said that the company's area of supply was now starved for cheap power, but if the company was able to make cheap power available the district would have a big future. The West Kent Co., he hoped to show, could supply the railway company more cheaply than the railway company could supply itself.

Sir Philip Dawson (consulting engineer to the London, Brighton & South Coast Railway Co.), who is advising the West Kent Co. in connection with the generating station it is proposed to erect at Belvedere, gave evidence, and submitted a number of tables. In the plans which he had prepared for the new station he had provided for 100,000 kW of plant running, and 50,000 kW spare; all the machines would be 25,000-kW sets. It was possible to extend the station on the Belvedere site to ten times the originally suggested size. The facilities for receiving and storing fuel were also excellent. The South Metropolitan Gas Co. had erected large works on an adjoining site. The cost of the first stage of the scheme, *i.e.*, the 150,000 kW for both railway and general supply, witness estimated to be £840,000. The bases of the calculations made by Mr. Sparks, which were dealt with at a previous hearing, were criticised by counsel, who sought to show that the figures given by Sir Philip Dawson were more reliable, and that the final costs of the power which could be supplied by the West Kent Co. would be lower than that of the power supplied by the railway company.

The inquiry then adjourned until Thursday.

On June 8th the evidence put before the Commissioners was mainly of a financial character, and concerned the financial position of the Metropolitan Carriage, Wagon & Finance Co., which is to invest 3½ millions in the West Kent Co. in the event of that company's obtaining the consent of the Com-

missioners to erect the proposed new generating station at Belvedere.

Mr. REGINALD MCKENNA (late Chancellor of the Exchequer) was the first witness. He gave evidence, as chairman of the London Joint City & Midland Bank, which is the bank of the Metropolitan Carriage, Wagon & Finance Co., to the effect that the company was financially sound, and that the bank would be willing to lend the necessary money to the company to make up the 3½ millions it was the intention to invest.

SIR EDMUND WYLDBORE-SMITH (Chairman of the Metropolitan Carriage, Wagon & Finance Co., and a director of the West Kent Co.) said that the Metropolitan Co. was prepared to invest the 3½ millions in the West Kent Co., and was going to take up the whole of the West Kent stock. The sum mentioned would be invested permanently. Answering a number of questions, witness admitted that if the South-Eastern Railway load were lost to the West Kent Co. the scheme would go. At a later stage Sir John Snell, questioning witness with regard to a remark that the West Kent Co. hoped to secure a contract to supply the London, Brighton and South Coast Railway in the future, pointed out that the Brighton Railway was tied to the London Electric Supply Corporation under an existing contract until 1927, and that when that contract expired the Corporation would have the first option of extending the contract.

At this point Sir John Snell questioned representatives of the various parties concerned in the inquiry as to the nature of their cases. He was anxious to finish the inquiry by the end of the week.

Mr. KENNEDY (representing the London Electricity Companies' Joint Committee) said that his clients were present to ascertain whether they were in a position to give a supply to the railway company at a lower rate than the railway company could supply itself. The Joint Committee was of the opinion that it was for it, if it thought it could, to put forward a figure, and if the railway company was content to enter into a binding contract, tables would be developed.

SIR JOHN SNELL said that the Joint Committee was entitled to appear.

SIR HARRY HAWARD suggested, amid laughter, that the Joint Committee would wait and see what everybody else could do, and then make an offer itself.

Mr. KENNEDY said that that was not the case; as a matter of fact, negotiations were already going on.

Mr. TURNER (for the Conference of Local Authorities) said he was present in order to show the effect of the West Kent Co.'s proposals on the scheme put up by the Conference at the inquiry held last summer.

SIR JOHN SNELL questioned the relevancy of this.

Mr. TURNER pointed out that he would show that, so far as the industrial supply in the West Kent Co.'s area was concerned, that could well be provided for from existing stations by interconnection and linking up.

Mr. CRAIG HENDERSON (for the L.C.C.) said that the L.C.C. was the purchasing body for the whole of the South Metropolitan area, and he had, therefore, a right to oppose.

Mr. TURNER said there were three or four district areas within the area covered by the West Kent scheme, in which the local authorities were the authorised suppliers, and he was entitled to oppose an application by the West Kent Co. to carry out a scheme which would affect the interests of those local authorities. Permission was asked for to put up a station which was admitted to be practically a capital station, to give bulk supplies in districts over which his clients had potential rights.

SIR JOHN SNELL said he would leave the matter there for the moment.

SIR PHILIP DAWSON was then recalled, and continued the evidence he had given on June 7th, in the course of which an offer was made by the West Kent Co. to the railway company. This was to the effect that energy should be supplied at £4 5s. per annum per kW up to a maximum demand of 25,000 kW (over either an hour or half-an-hour), and for any amount exceeding 25,000 kW, the price should be £3 5s. per annum per kW, plus, in each case, .252d. per kW-hour supplied. There were also to be rebates, according to the demand on the station other than the demand of the South-Eastern Railway. There were factors, however, which would have to be left open, such as the price of coal, wages, &c. The West Kent Co. was willing that a clause should be inserted in any such contract to the effect that, if some new type of plant which would considerably reduce the cost of production of electricity were invented, then the Power Co., under certain conditions, could be called upon to install that plant.

In the course of cross-examination by counsel for the railway company arguments arose as to the differences in connection with the figures in the tables prepared by Mr. Sparks and Sir Philip Dawson. At the suggestion of Sir John Snell, Mr. Sparks and Sir Philip agreed to meet after the adjournment with a view to coming to agreement on their figures so far as possible.

On the resumption of the proceedings on June 9th,

Mr. G. F. FOX (the general manager of the West Kent Co.) was called, and gave evidence to support that given by Sir Philip Dawson in his tables with regard to the general demand in the West Kent Co.'s area.

SIR PHILIP DAWSON then went on with his evidence, and referred to his discussions with Mr. Sparks with regard to their estimates of costs, from which it was to be gathered that they had agreed as to the capital cost of the Belvedere station at the first stage of the West Kent Co.'s scheme. After his evidence Sir Philip was subjected to a great deal of detailed cross-examination with regard to his tables by the various counsel. At length Sir John Snell intimated that this detailed cross-examination did not appear to bear much fruit. The cross-examination of the witness by Mr. Turner (on behalf of the Conference of Local Authorities), however, brought from him a definite expression of opinion that a joint electricity authority, run entirely by private enterprise, would always supply more cheaply than a joint authority on which local authorities were represented. Although witness agreed that the acquisition of the railway load would be a good thing for a joint electricity authority, it did not necessarily follow that it would be a good thing for the consumers.

In the course of re-examination, Mr. Tyldesley Jones said that, in response to a suggestion by Sir Harry Haward on the previous day that the West Kent Co.'s offer to the railway company should be put down in black and white, the offer had been printed, and copies were handed round. This set out the suggested heads of agreement. The company was to erect and equip a generating station at Belvedere and to provide the railway company with three-phase, high-pressure, a.c. at 25 cycles, the power for the first stage to be delivered at Lewisham Junction. Equipment was to be supplied sufficient to meet a maximum demand by the railway company for traction purposes of 30,000 kW in the first stage, and also, on reasonable notice, sufficient to meet any further demand for traction purposes of the railway company. If a contract was entered into by September 30th, 1922, the company was to have equipment sufficient to meet the maximum demand of 30,000 kW in working order, and ready to deliver energy at Lewisham by June 30th, 1925, subject to the provision that any delay in the construction of the generating station or equipment caused by *force majeure* or strikes was to be excused. If the contract was entered into at some date between October 1st and December 31st, 1922, the Power Co. must be ready to deliver the energy at Lewisham within three years of the said date. In the event of no agreement being entered into by January 1st, 1923, the West Kent Co. would be entitled to withdraw its offer. In the event of the electrification of the railways being completed by June 30th, 1925, or within three years of the date of the contract, and the railway companies being ready to take a supply from the West Kent Co., and the supply not being forthcoming, the West Kent Co. would pay damages to the railway company.

The railway company was to agree (1) in the event of the West Kent Co.'s complying with the aforesaid obligations, to pay for 89,000,000 kW-hours per annum (whether taken or not) from June 30th, 1925, or from three years from the date of the contract; and (2) to take from the West Kent Co. the whole of the supply necessary for traction purposes.

The suggested term of the agreement was a minimum of 60 years from the commencement of supply, or such longer term as the railway company might desire.

Payments would be on a monthly basis. The price would be as already stated. A rebate of 1 per cent. would be given when consumers other than the railway company took energy in any year ending December 31st equal to the amount taken by the railway company; 2 per cent. if consumers took energy equal to twice the amount taken by the railway company; and 3 per cent. if equal to three times the amount taken by the railway company. If the result of working the station was to show a greater thermal efficiency than 16.2 per cent. the price to the railway company would be reduced in proportion to the coal saving. The prices quoted were fixed on the basis of coal of a calorific value of 11,000 B.th.u. delivered at Belvedere at 15s. per ton. There were to be the usual coal and wages clauses.

The Metropolitan Carriage, Wagon & Finance Co. would guarantee the obligations of the West Kent Co. to have a supply ready by June 30th, 1925, or within three years of the date of the contract. A formal agreement would be entered into between the parties, and differences would be settled by a member of the English Bar, to be nominated by the President of the Law Society.

SIR PHILIP DAWSON said that the wages basis taken was that of the present rates.

A discussion then arose as the result of a statement previously made by Sir Philip Dawson that the supply would be given at .575d. from the start, but that, by means of a formula, the price would come down to .55d. Mr. Jones sought to show that by means of the rebates the price at the first stage would be .55d. Sir John Snell said it appeared that, on the estimated growth of the demand other than that of the railway company, this could not be done at the first stage. It appeared that the demand would grow to about 2½ times the estimated demand of the railway company at that stage. On the 3 per cent. rebate basis the price would be down to .556d., but on the 2 per cent. basis it would be .562d. Sir Philip said, in reply to Sir John Snell, that he

would be prepared to modify the rebate formula to bring the price down to .55d.

In reply to Sir John, Mr. TYLDESLEY JONES said that if sanction were given to the West Kent Co.'s scheme the company was prepared to stand by the prices mentioned whatever the cost to the company.

SIR HARRY HAWARD pointed out that hitherto the company had made offers on the basis of a principle, but now the offer was made on a definite price.

Mr. TYLDESLEY JONES said he was now able to make a definite offer because he had a date fixed, namely, June 30th, 1925. This date now came before the Commissioners for the first time.

Asked by Sir Harry Haward how long it would be after consent was given (assuming it was given) before the West Kent Co. could commence operations, Sir Philip Dawson said that the preparations were sufficiently advanced for it to place orders for boilers, &c., within two or three weeks.

SIR HARRY HAWARD was anxious to know how the offer to the railway company would be affected supposing the West Kent Co. obtained a favourable reply from the Trade Facilities Committee as to the guarantee, but counsel said he could not reply to that at the moment.

Mr. SPARKS was then re-called to reply to criticisms of his figures made by Sir Philip Dawson. He had not concluded his remarks when the inquiry was adjourned until Monday, June 12th.

(To be continued.)

THE EAST MIDLANDS ELECTRICITY DISTRICT.

MUNICIPAL AUTHORITIES' SCHEME.

AT Nottingham, on July 11th next, the Electricity Commissioners will hold a local inquiry to consider the scheme that has been submitted by a conference of municipal electrical undertakers for the establishment of a Joint Electricity Authority for the above-named area* under the provisions of the Electricity (Supply) Act, 1919. The administrative and financial provisions of the scheme have been framed on more or less similar lines to those of other schemes that have been outlined in our pages.

It is proposed that the Joint Authority shall consist of 20 members, 12 of whom are to be appointed by the local authorities supplying, or entitled to supply, electricity within the district, three by the county councils within the area, one by the companies supplying electricity within the district, two by the railway companies purchasing electricity from the Joint Authority, or from one of the constituent members thereof, and two by the large consumers in the area.

The technical part of the scheme proposes that the system of supply shall be three-phase alternating current, 50 periods, and that the needs of the area shall be met by four main stations and a fifth smaller station as follows:—(1) A main station at Leicester (already sanctioned†) of an initial capacity of 20,000 kW, and capable of extension to 50,000 kW. (2) A main station at Nottingham (already sanctioned†) of an initial capacity of 30,000 kW, and capable of extension to about 200,000 kW. (3) A main station at Derby (existing); the capacity of modern economical plant, including that now on order, is 19,750 kW, and the present site is capable of extension to 27,000 kW, and by the acquisition of adjacent property to 40,000 kW. (4) A main station at Burton-on-Trent (existing); the capacity of the existing modern economical plant is 7,500 kW, and the site is capable of developing up to at least 30,000 kW. (5) Possibly a new station at Newark of an initial capacity of 3,000 kW, on a site which will permit of the future erection of a station with a capacity up to 200,000 kW if necessary. The total capacity of plant which can be installed either in the above stations or on the sites is at least 500,000 kW. The existing stations at Loughborough, Mansfield, Melton Mowbray, Long Eaton and Ilkeston will be continued in operation until it is shown to the satisfaction of the Electricity Commissioners to be economically practicable to replace them with a bulk supply from a main station.

The main transmission pressure will be 33,000 volts stepped up from the generating pressure, and an intermediate pressure of 11,000 volts will be adopted from primary sub-stations and from main generating stations to new adjacent districts which could not be economically served at the present generating pressures. The main transmission lines will be partly overhead on steel towers and poles and partly lead-covered, paper-insulated cables, armoured and laid directly in the ground. Their construction will be gradual and be dependent upon the development of the load and the economic advisability of substituting bulk supply for local generation. The first stage of construction will be a 33,000-volt transmission line from Nottingham to a primary sub-station at Long Eaton, and on to Ilkeston to supply the Derbyshire and Nottinghamshire Electric Power Co. The next stage will comprise transmission lines to Mansfield, with a sub-station at Hucknall Torkard, and to Spondon, Derby and Burton; also to Loughborough and Leicester. The secondary mains for distributing at 11,000 volts will also be partly overhead on steel poles and partly underground cables similar to those used for the 33,000-volt transmission. The transformers and switchgear in connection with the main transmission lines will be accommodated as far as possible in existing power stations. New sub-stations will be built in other districts as required.

It is proposed that the areas of distribution of the municipal supply authorities shall be extended considerably beyond their present boundaries, provided that no authority shall be required to supply in such extended areas except upon satisfactory financial guarantees being given by prospective consumers. The Derbyshire and Nottinghamshire Electric Power Co., the Leicestershire and Warwickshire Electric Power Co., and the Melton Mowbray Electric Light Co. will continue to be the distributing authorities in their present areas. The Joint Electricity Authority will exercise distribution rights in those parts of the district which are not served by any of the above mentioned authorities, provided that the Joint Authority shall not be required to supply in such parts except upon satisfactory financial guarantees being given by the respective consumers.

The scheme will enable a supply of three-phase energy at 50 periods to be given from the main stations to suitable points for the supply of railways and tramways in the area as and when the demand arises.

It is not considered that the water power resources in the area are sufficient to justify any attempt to utilise them for the direct generation of electrical energy.

* ELEC. REV. November 5th, 1920; p. 591.

† ELEC. REV. July 30th, p. 155, and December 20th, p. 744, 1920.

PARLIAMENTARY NOTES.

[FROM OUR SPECIAL PARLIAMENTARY REPORTER.]

Parliament re-assembled, after the Whitsuntide Recess, on Monday, June 12th.

In the House of Commons on that day, the Nottinghamshire and Derby Tramways Bill was read the third time.

Electric Lighting Charges.—Capt. Viscount Curzon asked the President of the Board of Trade, whether, seeing that the electric lighting companies had increased their charges since 1914 in some cases by as much as 60 per cent., partly to keep up the dividends of their shareholders, and now only proposed a reduction of 5 per cent., in spite of the fall in the prices of material, he would appoint an expert committee to go into the question of the costs and staffing of the companies in the interests of the general public.

Mr. NEAL (Parliamentary Secretary to the Ministry of Transport) who replied, said that the increases in the maximum charges authorised to be made by electricity authorities had sometimes been made under the terms of their provisional orders incorporating Section 32 of the Schedule of the Electric Lighting Clauses Act, 1899, but in a majority of cases under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, and in each case after the Minister had considered a report by the Electricity Commissioners. Under these circumstances he did not think that the appointment of a Committee would be useful. He would be glad to look into any particular case to which the noble lord called his attention.

S.E. & Chatham Railway Electrification.—Mr. Gilbert asked the Parliamentary Secretary to the Ministry of Transport whether, seeing that the Government had undertaken to guarantee capital expenditure of six and a-half millions by the South-Eastern & Chatham Railway Companies for the electrification of their suburban lines; that it was a condition of the guarantee that the work should be started at an early date and be carried out within three years, and that the generation of the necessary power should be done at cost price; that the formal application of the railways to the Electricity Commissioners for consent to erect a generating station for the working of the lines was opposed by the West Kent Co.; that this company was itself promoting a scheme for putting up a station at Erith and was pressing to have the railway load in order to improve the financial position of what was in the nature of a speculative enterprise; that practically all the shares in the West Kent Co. were owned by the South Metropolitan Co., which had recently joined a large group of London electricity supply companies; that the opposition of the West Kent Co., if successful, was likely to delay the electrification of these railway lines and to increase the cost of power supply for the working of the lines; that any uncertainty of supply or inflated cost would have to be borne by the railway passengers; and that the erection of a non-purchaseable capital station at Erith would seriously affect the purchase rights of the London County Council, he would state whether the Advisory Committee under the Trade Facilities Act was aware, when it came to the agreement to assist the railway companies, that the consent of the Commissioners would be necessary for putting up the station; and whether there was

any consultation between the Treasury and the Ministry of Transport on the subject.

SIR R. HORNE, Chancellor of the Exchequer, said that the answer to both parts of the question was in the affirmative. He must not, however, be taken to concur in all the statements of the preamble, many of which were matters for argument.

Wireless Telegraphy Bill.—On June 13th, Mr. Kellaway, the Postmaster-General, introduced a Bill to amend the Wireless Telegraphy Act, 1904, and to make further provision with respect to the regulations of wireless telegraphy and visual and sound signalling. The Bill was read a first time.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

14,664/5. "Starting switches for electric motors." E. N. Bray. May 25th.
14,669. "Sparking plugs." F. J. Mills and G. H. Ward. May 25th.
14,674. "Electric incandescent, &c., lamp holders or fittings." W. Broady. May 25th.
14,678. "Directional wireless systems and apparatus." H. L. Crowther, W. H. Derriman and J. Robinson. May 25th.
14,685. "Electric switches, cut-outs, &c." A. F. Carter and A. M. Taylor. May 25th.
14,690. "Electric transmission systems." A. M. Taylor. May 25th.
14,694. "Electric signals for fire, police, or ambulance calls, &c." A. C. Brown. May 25th.
14,709. "Electric motor attachment for bath chairs, tricycles, &c." A. C. Nobbs. May 25th.
14,713. "Means for receiving alternating current electric signals." F. E. Pernot. May 25th.
14,729. "Electric heating utensils." F. J. Moller. May 25th.
14,731. "Conversion of kinetic energy contained in energy carrying fluids into electrical and mechanical energy." F. Hamer. May 25th.
14,740. "Dynamo-electric machines, &c." E. E. Collins. May 25th.
14,765. "Holders for electric lamps." W. S. G. Baker and J. Y. Fletcher. May 25th.
14,773. "Wireless signalling systems." British Thomson-Houston Co., Ltd. May 25th. (United States, May 25th, 1921.)
14,774. "Electrically separating suspended particles from electrically non-conducting gaseous, &c., fluids." Lodge Cottrell, Ltd. (Moller). May 25th.
14,781. "Terminals for electric batteries for miners' lamps, &c." Hart Accumulator Co., Ltd., and F. J. Holmes. May 25th.
14,797. "Electric battery." G. Weissman. May 25th. (France, May 25th, 1921.)
14,798. "Electric clock escapement damper." S. C. Midwinter. May 26th.
14,800. "Tramway steel line trimmer and cleaner." W. Wye. May 26th.
14,815. "Electric resistance welding." C. A. Hadley and Rose Street Foundry & Engineering Co., Ltd. May 26th.
14,820. "Electric lighting and starting installations for motor vehicles." R. Bosch Akt. Ges. May 26th. (Germany, May 30th, 1921.)
14,835. "Electric harmonic analysers." M. Walker. May 26th.
14,873. "Detectors for wireless telegraphy and telephony." H. R. Rivers Moore and R. M. Radio, Ltd. May 26th.
14,874. "Electric testing apparatus." W. H. J. Fuller and S. G. Sandeman. May 26th.
14,901. "Electric incandescent lamps." R. C. Philpott. May 26th.
14,905. "Process for making alloys." British Thomson-Houston Co., Ltd. (General Electric Co.). May 26th.
14,906. "Protective devices." British Thomson-Houston Co., Ltd. May 26th. (United States, May 26th, 1921.)
14,908. "Electric measuring instruments." Officine Meccaniche Italiane and L. N. Reddie. May 26th.
14,909. "Electric hot-water fountain." Hydrotherm Fabrik Elektrischer Apparate Ges. May 26th. (Germany, June 8th, 1921.)
14,917. "Electric disconnector." Soc. Internationale M. D. M. May 26th. (France, July 4th, 1921.)
14,942. "Electric transmission systems." A. M. Taylor. May 27th.
14,943. "Synchronous electric motors." J. M. Ford and A. B. Wood. May 27th.
14,950. "Electric ignition systems of internal-combustion engines." A. Hewlett. May 27th.
14,951. "Electric welding and burning device for use under water." J. McPherson. May 27th.
14,974. "Electric relays." British Thomson-Houston Co., Ltd. (General Electric Co.). May 27th.
14,980/1. "Multi-layer electric coils for wireless telegraphy, telephony, &c." H. L. Thomas. May 27th.
14,988. "Means for suspending reflectors, &c., from electric lamp holders, &c." J. S. Smith. May 27th.
14,989. "Amplification and rectification of oscillatory electric currents." W. G. Hill. May 27th.
14,990. "Signalling apparatus." M. F. Bell. May 27th.
15,000. "Electric current testing apparatus." A. Hewlett. May 29th.
15,003. "Adjustable removing and refitting apparatus for electric bulbs." G. C. Clark and W. J. H. Walter. May 29th.
15,004. "Electric transmission systems." A. M. Taylor. May 29th.
15,009. "Electric heating apparatus." E. Phillipson. May 29th.
15,019. "Spark-gap detector." Air Reduction Co., Inc. May 29th. (United States, June 7th, 1921.)
15,025. "Electric transmission mechanism." A. C. Hess. May 29th.
15,048. "Telephone, &c., receivers." P. L. Jensen and E. S. Pridham. May 29th.
15,049. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. May 29th. (United States, July 6th, 1921.)
15,052. "Electric switchboard, &c." F. W. Uren. May 29th. (Australia, June 29th, 1921.)
15,058. "Automatic, &c., telephone systems." V. Amberg. May 29th.
15,076. "Elastic-fluid turbines." Metropolitan-Vickers Electrical Co., Ltd. May 29th. (United States, July 21st, 1921.)
15,087. "Method of dissociating oscillatory electric circuits." Thüringische Landesuniversität eJna. May 29th. (Germany, May 27th, 1921.)
15,097. "Process for staking-out a route by phonic cables." W. A. Loth. May 29th.
15,105. "System generating electric power from water supplies." J. W. Ewart. May 29th.
15,109. "Machine for production of tubular metallic articles by electro-deposition." E. L. Gaston. May 29th. (France, June 3rd, 1921.)
15,133. "Device for locking electric lamp globes in holders." A. Wilkinson. May 30th.
15,135. "Direct-current circuit breakers." Forges et Ateliers de Constructions Electriques de Jeumont. May 30th. (France, March 21st.)
15,136. "Electric head-lights for motor vehicles." R. Bosch Akt. Ges. May 30th. (Germany, August 11th, 1921.)
15,143. "Combined switch and fuse." G. Eccleston. May 30th.
15,147. "Head-lights for motor vehicles." J. R. Sinton. May 30th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

22,240. "Process and apparatus for the utilisation of cosmic electricity." E. F. W. Rasch and E. Krist. November 15th, 1920. (179,967.)

1921.

47. "Headlights and the like." F. G. Piper. September 26th, 1921. (179,972.)
639. "High and low-frequency telephone systems." Ges für Drahtlose Telegraphie. January 7th, 1920. (156,655.)
989. "Arrangement for the suppression of the earth leakage current of high-voltage networks." Siemens-Schuckertwerke Ges. May 25th, 1918. (157,123.)
1,238. "Arrangement for the compensation of charging currents of high-voltage networks." Siemens-Schuckertwerke Ges. June 2nd, 1919. (Addition to 157,123.) (157,326.)
2,118. "Sparking plugs." P. Guenifley. January 14th, 1921. (179,980.)
2,298. "Vapour electric rectifier systems." Akt. Ges. Brown, Boveri et Cie. January 31st, 1920. (158,253.)
4,325. "Trolley-pole attachments for electric trams and the like." P. Priestley. February 7th, 1921. (179,996.)
4,723. "Magneto-electric machines for engine ignition purposes." A. G. L. Neighbour. February 10th, 1921. (180,002.)
4,855. "Electric motors for talking machines." J. T. Sibley. February 11th, 1921. (180,007.)
4,865. "Methods of and means for measuring unbalance of telephone and like lines." Western Electric Co., Ltd. (Western Electric Co., Inc.) February 11th, 1921. (180,008.)
5,031. "Electric conductors for internal wiring of buildings." D. S. Munro. February 14th, 1921. (180,020.)
5,239. "Cut-out for electric circuits." R. Kellendorfer. February 15th, 1921. (180,032.)
5,374. "Electric light fitting." J. Y. Fletcher and C. W. Saunders. February 16th, 1921. (180,038.)
5,404. "Sparking plugs for internal-combustion engines." W. Grägger. February 16th, 1921. (180,040.)
5,459. "Commutators for electric machines." J. E. Calverley and W. E. Highfield. February 17th, 1921. (180,045.)
5,524. "Electro-magnetic switches for controlling the circuits of train-lighting and similar installations." J. Stone & Co., Ltd., and A. H. Darker. February 17th, 1921. (180,049.)
5,709. "Dynamo-electric machines." Lancashire Dynamo & Motor Co., Ltd., and W. Stansfield. February 19th, 1921. (180,064.)
5,807. "Signalling systems, particularly the provision of duplex radio communication." J. Scott-Taggart and Radio Communication Co., Ltd. February 21st, 1921. (180,069.)
6,146. "Operation of alternating-current repulsion motors." British Thomson-Houston Co., Ltd. (General Electric Co.) February 23rd, 1921. (180,075.)
6,407. "Magneto-electric machines." British Thomson-Houston Co., Ltd. A. P. Young, and H. W. H. Warren. February 25th, 1921. (180,084.)
6,451. ""Electric hand lamps." J. Davison. February 25th, 1921. (180,085.)
6,479. "Electric heaters." British Brass Fittings, Ltd., and H. B. Butler. February 26th, 1921. (180,086.)
6,641. "Thermionic cathodes and methods of making the same." Western Electric Co., Ltd. (Western Electric Co., Inc.) February 28th, 1921. (180,090.)
6,736. "Electric fuses and holders for the same." J. J. J. M. Kluijtmans. March 1st, 1921. (180,093.)
7,216. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.) March 5th, 1921. (180,103.)
7,241. "Electric generators." J. W. Torrance and J. M. Torrance. March 7th, 1921. (Addition to 162,966.) (180,104.)
8,009. "Ignition devices for internal-combustion engines." British Thomson-Houston Co., Ltd., and A. P. Young. March 14th, 1921. (180,113.)
8,089. "Automatic electro-magnetic switch." F. Krupp Akt. Ges. December 20th, 1920.) (173,201.)
8,256. "Electric primary cells." L. Darimont. March 16th, 1921. (180,120.)
8,496. "Machines for making electric incandescent lamps and the like." British Thomson-Houston Co., Ltd. (General Electric Co.) March 18th, 1921. (180,125.)
9,366. "Control of electric motors." S. Gowan, R. Brooks, and Metropolitan-Vickers Electrical Co., Ltd. March 29th, 1921. (180,138.)
9,724. "Dynamo-electric machines." W. E. M. Ayres. April 1st, 1921. (180,142.)
9,741. "Automatic electric switches." H. Lucas, O. Lucas, and H. W. F. Ireland. April 1st, 1921. (180,143.)
9,933. "Galvanic batteries." G. Oldham and J. Oldham. April 4th, 1921. (180,144.)
10,172. "Electric illuminating control systems." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.) April 6th, 1921. (180,146.)
10,236. "Trip mechanism for oil circuit breakers." L. E. Wood. April 7th, 1921. (180,147.)
10,239. "Sparking plugs for internal-combustion engines." S. P. Shaw. April 7th, 1921. (180,148.)
10,614. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. April 19th, 1920. (161,950.)
11,517. "Boxes for containers, more especially intended for electric batteries or accumulators." New Eccles Rubber Works, Ltd., and S. W. Cox. April 21st, 1921. (180,170.)
12,010. "Plug-box for electric installations." W. Sack. May 21st, 1920. (163,688.)
12,140. "Electric heaters." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.) April 27th, 1921. (180,179.)
12,882. "Commutators or rotary electric current distributors." A .H. Steptoe and E. G. Steptoe. May 5th, 1921. (180,188.)
14,574. "Means for actuating electric relays." Ges für Drahtlose Telegraphie. July 23rd, 1920. (166,881.)
15,827. "Cooling apparatus for electric oil transformers." Akt. Ges. Brown, Boverie et Cie. December 9th, 1920. (172,601.)
17,812. "Speed-regulating means for dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.) June 30th, 1921. (180,230.)
18,466. "Electric motor controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). July 7th, 1921. (180,236.)
19,227. "Protective devices for alternating-current systems." Ateliers de Construction Electriques du Nord et de l'Est. August 4th, 1920. (167,467.)
19,450. "Electro-pneumatic braking apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. March 17th, 1921. (177,127.)
19,647. "Electric railway control systems." Metropolitan-Vickers Electrical Co., Ltd. July 30th, 1920. (167,166.)
20,930. "Electrical switching devices suitable for telephone and like plants." Relay Automatic Telephone Co., Ltd. September 8th, 1920. (168,870.)
21,474. "Control of electric motors." British Thomson-Houston Co., Ltd., H. C. Hastings, and H. F. Farmer. August 12th, 1921. (180,249.)
21,475. "Control of electric motors." British Thomson-Houston Co., Ltd., H. C. Hastings, and H. F. Farmer. August 12th, 1921. (180,250.)
31,873. "Electric power integrating and limiting systems." Forges et Ateliers de Constructions Electriques de Jeumont. December 3rd, 1920. (172,300.)

1922.

2,706. "Electro-magnetic overload circuit breakers." F. Krupp Akt. Ges. February 24th, 1921. (175,965.)
8,471. "Electric arc welding systems and apparatus therefor." British Thomson-Houston Co., Ltd. (General Electric Co.). (Divided application of 179,613.) February 4th, 1921. (179,883.)